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Edited by

P. H. GREGORY and W. C. MOORE



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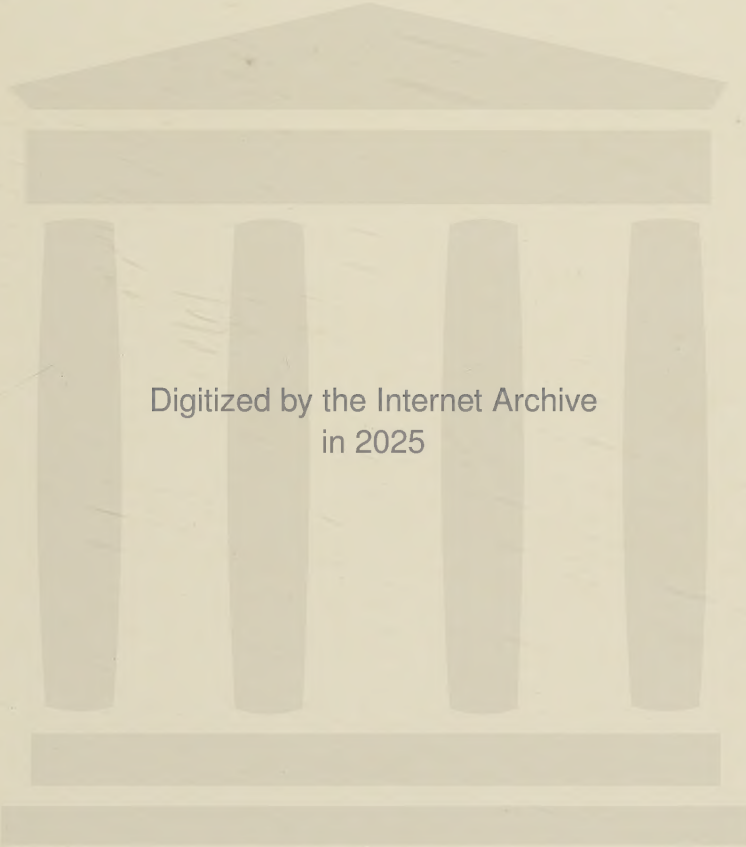
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Dr W. P. K. FINDLAY
PRESIDENT, 1949

PRESIDENTIAL ADDRESS

TREE AND TIMBER FUNGI

By W. P. K. FINDLAY, D.Sc.

(With Portrait)

According to Horace: 'the meadow fungi are in kind the best; it is ill trusting any of the rest'. *Pratensibus optima fungi natura est, aliis male creditur*. Whatever evil properties the Amanitas and other denizens of the forest floor may possess, I think it is a fact that none of the fungi which actually grow on trees and timber are deadly to man—a number of them are in fact good esculents and some of them have provided man with useful materials such as amadou and tinder.

The giant species of *Polyporus* and *Fomes* are probably among the largest fungi that exist and they have attracted the attention of naturalists from the earliest times. It is strange that the taxonomy of these fungi is still in a state of flux and that one can find such a common fungus as the Birch polypore being given in current literature at least three different generic names! Gerard dismissed the fungi that grow out of wood, 'forth of the rotten bodies of trees, as unprofitable and nothing worth'. He figured a *Polyporus* species under *Fungi lethales sive non esculenti*.

As far as I can discover the first scientific paper by a botanist which was devoted to wood-rotting fungi was the report by Sowerby, to which our past President Dr Ramsbottom referred in his interesting address on 'Dry Rot in Ships', which he gave to the Essex field club in 1937. Sowerby was asked by the Admiralty in 1821 to inspect and report on the *Queen Charlotte*. In this ship, a first-rate of 110 guns, in which decay had proceeded so quickly that within 14 months after her launch, all the planking and many of the timbers had to be removed. Sowerby listed a score or so of fungi that he found in the vessel; although he did not expressly state that decay was brought about by fungi, he evidently appreciated the extremely close association between the presence of fungi and the development of rot in the wood, and realized that the conditions that favour the one are conducive to the latter.

The role of fungi in the causation of plant diseases was not really understood until after the Rev. Berkeley had carried out his classical work on potato murrain, and it was even later before it was realized that fungi are the cause and not the result of decomposition in organic materials such as timber.

Theodor Hartig, in 1833, was one of the first to appreciate the important role that fungi play in bringing about decay of wood, but he thought that the hyphae which appear in decayed wood develop spontaneously and then by their vegetation accelerate the decomposition. It was his son, Robert Hartig, whose brilliant investigations laid the foundations of our knowledge

of forest and timber pathology. His work is familiar to most of us through the English translation by Somerville, which was revised by Marshall Ward in 1894, who spoke of him as 'a sturdy and patient enquirer', as an admirable anatomist and physiologist and as a bold and original thinker and referred to the astounding richness of information his book conveys. I would counsel those who have seen his work only in the English translation or second-hand in Tubeuf's *Diseases of Plants*, to examine the original publications, *Die Krankheiten der Waldbäume*, 1874, and *Die Zersetzungsercheinungen des Holzes*, 1878. Hartig was an excellent draughtsman and the plates illustrating the various diseases and rots and the microscopic appearance of the hyphae in the wood have never been excelled.

This classical work of R. Hartig's dominated forest pathology until the end of the century and one finds his illustrations copied again and again in subsequent work. Hartig also discovered that the bluish grey stain in coniferous sapwood which often develops soon after felling was caused by a Pyrenomycete which he called *Ceratostoma piliferum*. The dark-coloured hyphae of this fungus in the rays, give rise by an optical effect to the so-called 'blue stain'. The first systematic study of the species involved was undertaken by Münch in Munich, whose paper on 'Die Blaufaule des Nadelholzes', published in 1908, was the starting-point for the systematic study of these fungi in Europe.

The German influence in forestry was so strong that it led to some mistakes when the text-books were translated; for instance, *Fomes fomentarius* is a common fungus in Germany and it was assumed to be equally common in this country and many collections of *F. applanatus* were, in consequence, wrongly identified. Marshall Ward noted *F. fomentarius* as common in England; actually it is exceedingly rare in the southern half of our island.

Hartig himself published in 1885 a book on the dry rot fungus, *Merulius lacrymans*, and a number of workers were studying the dry rot problem in Germany towards the end of last century. Their work is usefully summarized by Carl Mez in his little book *Der Hausschwamm*, published in 1908.

The work of Richard Falck on *Merulius lacrymans* and certain other species that occur on building timber is in a class by itself. His monographs published as the *Hausschwammforschungen* describe in the greatest detail the anatomy of these fungi and the many ingenious experiments that he carried out on their physiology. They were beautifully illustrated by the fine drawings of his wife Olga Falck. It is sad to know that the manuscript of another similar volume devoted to *Coniophora cerebella* was lost during his escape from Warsaw in August 1939. Falck has also carried out a great deal of research on practical means for combating dry rot and devised and improved various methods of wood preservation.

What were we in Great Britain doing about forest and timber pathology all this time? Very little, I regret to record. Marshall Ward published a little popular book in 1889 on *Timber and some of its Diseases*, and contributed a few papers on various wood-rotting fungi. Somewhat later, Buller, Biffen, the Rev. M. C. Potter and a few others studied individual fungi and their effect on various timbers. Nowhere in this country did a school of forest or timber pathology develop until after the 1914-18 war. Prof. Percy Groom, appointed to the chair of timber technology at the Imperial College

of Science and Technology, was familiar with the work of Falck and other German investigators and well qualified to interpret it to English inquirers but he himself did but little original work in this field. Several popular books on dry rot have appeared in England, e.g. MacWilliams in 1818, Britton in 1875 and Blake in 1925, but scientific investigation of the problem was strangely lacking.

In the United States, the first serious investigations of tree and timber diseases were undertaken in St Louis by Hermann von Schrenk, who accomplished an amazing amount in a few years and published a series of long papers on the diseases of deciduous and coniferous trees, illustrated with unusually excellent photographs. Starting from scratch, he firmly laid the foundations of forest pathology in America. His interest in wood preservation has continued up to the present day. I have very pleasant memories of my meetings with him in 1931 when he presided over an informal conference in Berlin to discuss standardizing methods for the laboratory testing of wood preservatives. His tact and charm enabled him to bring to a successful conclusion discussions that might otherwise have become acrimonious. The standard method for testing that we now use in this country is largely the result of the work of a committee set up by this conference. No one man has done more in the present century to further the science of wood preservation than von Schrenk.

With the establishment in various countries of special Forest Products Laboratories to study timber in all its aspects, our knowledge of wood-rotting fungi has increased greatly in the last 25 years, and it would be tedious to mention by name all the individual workers and their contributions.

One of the first problems to be tackled was the development of a method for identifying the causal fungi in samples of wood in which the rot had no characteristic features by which it could be recognized. Only a few fungi produce decays that are sufficiently characteristic for them to be readily recognized even in their final stages, and it is almost impossible to recognize the majority of the rots when they are in the incipient stage.

Microscopic examination of the hyphae and of their effect on the cell walls of the wood can sometimes tell one a little more, the presence or absence of clamp connexions on the hyphae, the diameter of the bore holes in the fibre walls and so on may help to distinguish species, but are seldom by themselves conclusive evidence. *Armillaria mellea* does, however, produce a zone line which is highly characteristic under the microscope, for it consists of a pseudoparenchyma of inflated hyphal cells that look extremely like tyloses.

Clara Fritz was probably the first to suggest that cultivation of these fungi on artificial media would be the most rapid and certain method for their identification, and she published in 1923 full descriptions of a number of fungi isolated in Canada from decayed coniferous trees. About the same time Cartwright in this country was beginning to build up his collection of standard cultures for the Forest Products Research Laboratory which now contains about 400 species and strains. We have since found this collection to be of the greatest value in our work. It remains one of our first duties to maintain this collection in first-class condition and to extend it by the

inclusion of new cultures prepared from properly identified sporophores or by exchange with other workers. As most of you probably know, the importance of collections of cultures was emphasized at the official Commonwealth Scientific Conference in 1946, and a specialist conference was called a year later to make better arrangements for their maintenance. Our collection at Princes Risborough now forms a part of the National Collection of Fungus Cultures, under the direction of the Commonwealth Mycological Institute, and many requests for cultures, both from research workers and from industrial laboratories, are supplied.

Several attempts have been made to work out diagnostic keys for the identification of fungi in culture, and last year Nobles in Canada published a key to 126 species of wood-rotting fungi, using a numerical 'key pattern' for classification of the characters. She defined as precisely as possible the terms which she used for describing the cultures. One of the great difficulties that arise in describing cultures is the definitions of the various textures that develop in the mat. Since the origin of any unidentified culture is usually known, we have found it convenient to limit keys of this kind to fungi isolated from particular timbers or from particular groups of timbers. We are now attempting to use a perforated card system for rapid identification of cultures and I think we shall find that is a very convenient way both of recording the descriptions and of providing a general key. By this system it is possible to use the diagnostic features present in *any order*; for instance, if a fungus has a bright colour, or a pronounced odour that character can be used for the first stage of selection.

Just as with bacteria, certain physiological characteristics can be very useful in diagnosis. The rate of growth under standard conditions and the optimum temperature for growth are both useful: for instance, the dry rot fungus, *Merulius lacrymans*, does not grow above 25° while *M. silvester*, a somewhat similar species, will grow up to a temperature of 30° C. The production of an oxidase in the culture medium will indicate whether the fungus is able to attack lignin and bring about a so-called white rot of wood in which all its chemical constituents are attacked.

The study of fungi in culture is valuable not only for identification purposes, it can also be of assistance in elucidating problems of taxonomy, particularly in groups such as *Poria* where the morphological distinctions are ill defined. Please do not imagine that I am suggesting that one ought to culture any and every fungus before attempting to identify it. What I do wish to stress, is that the study of fungi in culture is an essential part of taxonomic research in certain groups; in some groups such as Agaricaceae it may be of little or no value, in others such as the resupinate Polyporaceae it may be the only way in which the identity of the resupinate forms of Polypores can be associated with the normal fully developed bracket forms. Baxter, in his long series of papers on the *Porias* from the region of the Great Lakes, has made full use of cultures in their determination. I need not elaborate further on the value of the cultures in taxonomic work, for Cartwright dealt with this subject in his Presidential Address in 1937.

The study of the physiology of fungi was in its infancy in 1920, but Zeller in St Louis had already published a series of papers on the physiology of wood fungi. The mechanism by which they bring about the destruction of

lignified tissues, which are resistant to the attack of so many of the lower fungi that can readily destroy the unlignified softer tissues of plants, remained obscure until the problem was investigated by the wood chemists, who showed that the brown rots in which cellulose and associated pentosans only are attacked, mainly involve a hydrolytic action similar in effect to mild acid hydrolysis, while oxidation occurs when lignin is attacked by those fungi that cause white rots.

The enzymes by which fungi are able to attack lignified cellulose have so far received comparatively little attention; it is difficult to prepare extracts from the mycelium that are active, and little is yet known about the nature of the enzymes or their mode of action; here is a field that would yield interesting results if properly investigated.

Few of the wood-rotting fungi can utilize inorganic nitrogen in the absence of vitamin B₁, but the addition of nitrogen in any form tends to accelerate the decomposition of wood, a fact that Dr Rayner used when preparing her composts from sawdust for use in forest nurseries.

Light has a most important effect on the fructification of fungi in culture; we always find that it is much easier to obtain the fructifications during the summer months when the daylight is more intense. Few species are able to fruit in complete darkness, but even brief exposures to light of low intensity may suffice to stimulate the production of sporophores. Under conditions of low light intensity, as in buildings and mines, fructifications are often abnormal and a rare crop of queer abortions can be collected on the timbers in a damp mine. Some Agarics—like *Lentinus lepideus*—produce long branched sterile outgrowths completely lacking in any pileus. Many Polypores, on the other hand, produce under these conditions only a poroid fertile layer, with little or no sterile tissue.

Many wood-rotting fungi are resistant to heat and will stand quite long exposures of temperatures up to 60° C. (140° F.); at a slightly higher temperature, i.e. 65° C. (150° F.) most of them are killed fairly quickly; the increase in rapidity with which they are killed over this small rise in temperature is striking, evidently some critical temperature is reached between 60° and 65° C.

The resistance of some species to desiccation is remarkable. Species of *Lenzites*, such as *L. saepiaria* and *L. abietina* that one finds so commonly on softwood fencing in Europe, will grow in thin pieces of wood fully exposed to the sunshine, growing whenever the wood is wet and going into the dormant condition when it dries out. We started some experiments five years ago to find out how long some of these fungi can remain alive in air-dry wood. Some species are still alive after five years in wood at 12 % moisture content, and I am beginning to doubt whether I shall live to see the end of this experiment! The practical implications of these tests is that one cannot depend on storage under dry conditions to kill out fungal infection when it is once present in wood. Heat is a far more effective way of killing xerophytic fungi than desiccation. The use of X-rays for sterilizing wood affected by fungi has been suggested, but some recent tests by Dr Norman P. Henderson have confirmed the extremely high resistance of *Merulius lacrymans* to these rays, dosages that would more or less kill a man leave *Merulius* unaffected! Heating by high-frequency dielectric currents is

a much more promising method, but there are practical difficulties in applying this method of heating in a building or in a ship, though it is already used in factories for accelerating the setting of glues in wooden joints.

Until recently the metabolic products of the higher fungi had received very little attention from the biochemists in comparison with the comprehensive investigations that have been carried out on such moulds as *Aspergillus niger*. Still it is surprising if one reads Zellner's *Chemie der Höheren Pilze*, 1907, to see how much analytical work had been carried out by that date on the substances present in the sporophores of Agarics and Polypores. Bourquelot and others had examined the types of sugar present in some 200 species of Agaricaceae. One of the first fungi to attract the attention of chemists was *Fomes laricis* (*F. officinalis*), which contains a resinous material having sudorific and purgative properties, and analyses of this product were made by Buchholz as early as 1808.

Modern technique for investigating the metabolic products of fungi involves the cultivation of the fungus on a liquid medium of known composition from which these products can be isolated and identified. We have now been collaborating for some years past with Prof. Raistrick and Dr Birkinshaw, of the London School of Hygiene and Tropical Medicine, whose work on the metabolic products and pigments of moulds is so well known, and a number of interesting chemicals synthesized by Basidiomycetes growing in culture have been isolated and identified. One of the most surprising was methyl mercaptan. I noticed that when *Schizophyllum commune* was grown on a synthetic medium containing sulphates it produced an exceptionally foul odour. Dr Birkinshaw was able to collect this gas from a battery of culture flasks and showed that it consisted of methyl mercaptan; this was, I believe, the first recorded instance of the methylation of sulphur by a fungus. The production of trimethyl arsine by cultures of *Scopulariopsis brevicaule* growing in the presence of arsenic, by methylation of the arsenic had, of course, already been described by Prof. Challenger of Leeds.

Work on the metabolic products of all kinds of fungi had been greatly stimulated by the interest in fungal antibiotics, and the possibilities of the wood inhabiting Basidiomycetes have not been overlooked. Our host here, Dr Wilkins, has diligently investigated the antibiotic activity of all the cultures in the Princes Risborough collection, along, of course, with many hundreds of other Basidiomycetes, and the results obtained with a number of wood-rotting species are sufficiently positive to warrant further investigation. Prof. Bose of Calcutta claims that the common red *Polystictus sanguineus* of the tropics produces an antibiotic that is highly effective.

The study of the metabolic products of fungi may provide a clue as to why some species are highly resistant to certain fungicides: for instance, *Lentinus lepideus*, which is unusually resistant to coal tar creosote, produces in culture methyl anisate and is known to possess the power to methylate certain compounds. Is its resistance to creosote due to this ability to methylate and render harmless to itself the phenols present in the creosote? A number of wood-rotting fungi, particularly certain *Poria* spp., show a surprisingly high resistance to copper and can attack wood containing

3 or 4% of certain copper compounds. It has been suggested that by producing oxalic acid these species are able to precipitate the copper in a form non-toxic to the fungi. Conversely it is known that many species produce appreciable amounts of organic acids that may bring into solution toxic compounds precipitated in an otherwise insoluble form in the wood. This was the theory on which the zinc meta-arsenite process for preserving wood was based.

Further study of the metabolic activities of wood-rotting fungi will therefore be of interest not merely for elucidating the physiology of their vital processes, but also for the development of new and improved preservatives.

The mechanism by which fungal hyphae penetrate the cell walls of plants has interested many investigators. There is a striking difference between the behaviour of the hyphae of true wood-destroying fungi and of the sap-staining Ascomycetes such as *Ceratostomella*. The former penetrate the walls without any evidence of pressure being exerted by the hyphae, suggesting that the wall has been considerably softened and modified by the fungal enzymes—usually the bore holes are further enlarged after the passage of the hyphae. The sap-stain fungi, such as *Ceratostomella* sp. that are not known to have any appreciable chemical action on the cell walls, appear to exert considerable pressure on the cell walls and to penetrate mainly by mechanical means, never enlarging the bore holes once the hyphae have passed through the wall. We have recently found that in wood exposed to the continuous action of warm water, an unusual type of penetration occurs in which the hyphae penetrate the cell walls *longitudinally*—apparently following the angle of cellulose micellae in the wall. Mr Savory is at present engaged in isolating and identifying the species involved, and all that we can say at present is that they are definitely not Basidiomycetes. It is possible that the study of the breakdown of the lignified cell walls by fungi will throw additional light on their fine structure. The enzymes produced by fungi are much milder analytical reagents than the strong acids and alkalis normally used in the analysis of wood, and by studying the chemical composition of wood in the earlier stages of decay we may learn something more about the way in which the various components of the cell wall are linked together.

One can follow the depletion of cellulose by examining sections under polarized light from crossed nicols, but the walls continue to show double refraction so long as any cellulose remains, so this method does not reveal very much during the early stages of fungal breakdown. It is possible that X-ray photographs of wood in various stages of decay may disclose something about what is happening to the cellulose at various stages in its decomposition by fungi.

How do we stand regarding our knowledge of the fungal flora of various timbers in different parts of the world? Here I think we must distinguish between those fungi that are true wood-destroyers and which are able to break down lignified cellulose, and the micro-fungi which do little or no damage to the wood substance, and derive their nourishment from reserve food materials or extractives. The distinction is not, of course, an absolutely hard and fast one, but it is a convenient one. Considering first the wood-

destroying types, probably most of the European species have been described, though there are some groups such as the *Leptoporus* group of White Polypores that badly need systematic investigation, for the original descriptions of many of the species are inadequate, and it is almost impossible to decide to which species some of the names given by the older mycologists apply. Probably we shall never know to which fungus the name *Polyporus destructor*, so widely used in the past, should apply.

We have found that *Hyménomycètes de l'Europe*, by Bourdot and Galzin, is an outstandingly useful work for identification of the Polyporaceae and Thelephoraceae, and what is particularly useful for the timber mycologist is the inclusion of notes about the type of rot in the descriptions of most of the species. The volume on Polyporaceae by Pilát in the *Atlas des Champignons de l'Europe* is most useful, for it includes a good deal of general information about the species described, and it is copiously illustrated.

As in so many other groups of plants, the flora of Great Britain is poorer in Polyporaceae than that of the mainland, but from time to time new species are recorded, or rare species that one had given up hopes of finding are picked up. I remember at the Bristol Foray, which was a particularly barren excursion owing to drought, some one brought in a magnificent specimen of *P. spumeus*. Recently, when I was inspecting stacks of decayed railway sleepers cut from home-grown beech trees, I found sporophores of *Trametes hispida*, which is, I think, a new record for this country; it is rather like *T. rubescens*, but with a brown context and a hairy upper surface. It is interesting to note the absence or rarity in this country of certain fungi that are extremely common in Europe, and which must have been imported in a living condition in timber imported from Europe. *Polyporus tomentosus* and *Fomes pinicola*, both extremely rare in Great Britain, are common enough in many parts of Europe. *Trametes pini*, one of the commonest fungi in Central and Northern Europe, is now a rare plant in Great Britain—personally I have found it only in the Grampians. *Fomes fomentarius* seems to be more or less confined to the Highlands. The rarity with which some of these heart-rot fungi form fertile fructifications on sawn timber probably explains why they have not spread from the imported timber to trees in this country. This explanation would not apply to *Lenzites sepiaria*, which is as common as *Polystictus versicolor* in many parts of Europe, yet is found here only occasionally on coniferous wood in the open. One could go on giving examples of this kind.

One reason why the larger Polypores tend to be less common on conifers in this country than on the Continent, is because we now have so few large old conifers left—there are no tracts of over-mature coniferous woodland in Great Britain—and even comparatively few really old individual trees on which these fungi flourish.

With broadleaved trees, the position is rather different; in our parks there are many oak and elm trees of great size, in various stages of decrepitude, and my impression is that such fungi as *Fistulina hepatica*, and *Fomes ulmarius*, are much commoner here than in the better managed woodlands in Europe.

As you know, the fungal flora of North America includes many of the species that occur in Europe, and I find Lowe's *Polyporaceae of New York State*

a very useful book. Just as the American flora contains many more tree species than the European, so does it contain many more species of wood-rotting fungi. The Polyporaceae of the United States and Canada have been intensively studied by Murrill, Overholts and others, who have published monographs on them.

Turning to the East, we find that wood-rotting fungi have been studied in Japan and in India. Bose in Calcutta has written on the Polyporaceae of Bengal, and Bagchee at Dehra Dun has collected a great deal of new material which I hope he will be able to publish shortly.

In Australia, Tamblyn and others are studying the heart rots of the *Eucalyptus* spp.

But as regards the tropics, I think we are still in much the same position as we were twenty years ago when Miss Wakefield said in her Presidential Address in 1929: 'we are still, however, only on the fringe of real knowledge of tropical fungi', and drew attention to the need for more knowledge about the host range of timber-destroying fungi.

In the Crown Colonies, there are extremely few systematic mycologists, and the plant pathologists are usually far too busy to undertake systematic work on any fungi except those parasitic on agricultural crops. So far as I am aware, none of the Colonial Forest Departments employs a mycologist, though one has recently been appointed to the East African Research Institute to work on diseases of *Cupressus*.

The absence of good fungal floras deters many people from taking up the study of fungi—if anyone in the forest or agricultural services becomes interested in fungi he has few means of identifying even the commonest species that he finds. At the Forest Products Research Laboratory we meet many forest officers home on leave, and I am endeavouring to arouse their interest in timber fungi so that they will collect specimens of the species that they find on the logs and trees in their territories. Fortunately the majority of Polyporaceae retain their characters after drying sufficiently for them to be recognizable. We have already received collections from West Africa, Mauritius and British Guiana, and I am hoping that as more forest officers become interested, so we will get a sufficient number of collections sent in for us to begin to build up a picture as to what are the most common species of wood-rotting fungi in the various tropical Colonies. If we could supply these men with even an elementary flora that would enable them to recognize some of the commoner species, I think we should find it much easier to arouse their interest and lasting co-operation. The only volumes that I know which deal comprehensively with Polyporaceae of the tropics are the works of C. G. Lloyd which are not readily available and which, as many of you know, are not always easy to use. But it is only the woody forms that can be tackled in this way—as Miss Wakefield pointed out in her Address, to which I referred just now, our knowledge of fleshy fungi in the tropics can be advanced only by mycologists working on the spot.

One of the difficulties that faces anyone taking up systematic work on Polyporaceae is the delimitation of the genera. The Friesian genera, *Lenzites*, *Trametes* and so on, based on the shape of the hymenial layer may be adequate for a subdivision of European species, but become almost meaningless when one attempts to fit into these genera some of the tropical

species, which exhibit in one and the same specimen the characteristics of both genera. The genus *Polyporus* containing between 200 and 300 species, ranging from small brown central stalked forms like *P. perennis* up to massive, pale coloured, soft forms like *P. sulphureus*, is obviously not a single genus in the same sense as we use the word in flowering plants. To-day the genus *Polyporus* has, in a sense, reached the stage in which Fries found *Agaricus*—a number of groups within the genus have been recognized and many people have had a shot at producing satisfactory generic groupings. Some of these have been more successful than others. We must include the species of *Fomes* in any scheme by which we propose to subdivide *Polyporus*, for we cannot regard the perennial habit as a good basis for a natural classification. Imagine the confusion into which that would lead us in dealing with flowering plants! Karsten was the first to propose a new classification of the Polyporaceae, and his genus *Ganoderma* for those species of *Fomes* with brown truncate spores has been generally but not universally accepted. The French mycologists have led the way in the study of the Polyporaceae. Patouillard, in his *Essai taxonomique*, proposed the subdivision of *Polyporus*, *Fomes* and *Polystictus* into a number of fairly well-defined subgenera, most of which have found permanent acceptance in France. As I mentioned earlier, we find Bourdot and Galzin's book the most useful yet published on Polyporaceae, and they have used Patouillard's system as the framework on which their classification is based. Murrill, in the *North American Flora*, introduced a very large number of new genera, few of which have been generally accepted. In fact, his enthusiasm for subdividing the genus has, I think, made the more conservative of the American mycologists stick rigidly to the Friesian genera. *Polyporus* being sometimes retained even for *Polystictus versicolor*.

In recent years, several systematists, including Donk, Pilát, and Bondartzew and Singer, have essayed various rearrangements of the genera, and have made in consequence large numbers of new combinations.

Corner approached the problem from a new angle, seeking additional fundamental characters on which to base a natural classification of the Polypores. He has investigated closely their microscopic anatomy. He was able to distinguish in the context of the sporophore various types of hyphae which he called generative, skeletal, etc., according to their functions.

Anyone who has handled Polyporaceae or Agaricaceae realizes how fundamentally important is their texture for their recognition: *Fomes annosus*, for instance, may be any shape, and when resupinate it may not show any of the typical colour, yet its identity is revealed the moment you handle it. I know of no other Polypore in this country that has the same tough, leathery texture. Now this useful diagnostic feature of texture is one that is difficult to describe and hard to measure quantitatively. It is, of course, directly related to the type and distribution of the hyphae that go to build up the sporophore, and so by studying microscopically the hyphae of the context, one can more accurately define the texture that will be formed.

Cunningham in New Zealand has applied Corner's ideas for a funda-

mental re-classification of the Polyporaceae, and has published some nine or ten papers re-describing the New Zealand Polyporaceae and fitting them into his scheme. When Cunningham was in England recently, he took the opportunity of going through all the Polyporaceae in the Kew Herbarium so he has been able to get a wide view of the whole group. Though I have not been able to study his proposals in detail, I am convinced that he has produced a scheme for the taxonomic revision of the Polyporaceae which is more soundly based than any that has been previously suggested. It is sincerely to be hoped that systematic mycologists will be able shortly to reach agreement on the generic subdivision of the Polyporaceae, for the position really is chaotic to-day when well-known fungi are listed under three or four different generic names in as many countries and Linnaeus's ideal of one name for one plant is mocked. One cannot demand and does not expect finality in these matters of taxonomy, but would it not be possible at some future International Congress to get down to a serious discussion of the taxonomy of this important group and for the leading authorities in it to produce a scheme which we would agree to try out for a number of years and to alter only after further International discussions?

When generic names are in such a state of flux, I feel that it is all the more important that we should be able to hold on to the specific epithet. Let us, if we may, hold on to the epithet *betulinus* whether we put it in *Polyporus*, *Placodes*, *Ungulina* or *Piptoporus*. Let us nail *schweinitzii* to the mast, even if the mast has to be shifted from *Polyporus* to *Cladomeris*, to *Inodermus*, to *Phaeolus*, to *Hapalopilus* before reaching its present resting place in *Coltricia*, a genus proposed by S. F. Gray and revived by Cunningham. Amidst this welter of names only *schweinitzii* persists to guide us—lose that and anyone unfamiliar with the authorities for all the names will be lost too. Hence the interest I have shown in finding some mechanism by which the specific epithet of well-known fungi of economic importance can be retained against changes necessitated by rigid application of the rules of priority.

I am not suggesting that either of the specific epithets I have mentioned are in danger of being changed for this reason, but names equally familiar have been changed, and it is the principle of providing some legal method for retaining these well-known names for which I plead.

So far I have been speaking about timber-rotting fungi; let us consider for a moment how our knowledge of other wood-inhabiting fungi stands. The first lignicolous fungi other than the wood-rotting species that attracted attention were those that cause the so-called sap-stain or blue stain in the sapwood of coniferous woods, and I have already mentioned Münch's pioneer work on these forms. These fungi are of economic importance because they give the wood a dark bluish grey tinge which spoils its appearance for many purposes. This colour is not secreted by the hyphae and the cell walls do not themselves become stained. The colour is an optical effect resulting from the dark brown hyphae being seen through the translucent cell walls.

Our knowledge of these forms has increased greatly in the last twenty years, thanks to the studies of Scandinavian workers such as Melin, Nannfeldt and Robak, and of Rumbold and Davidson in the United States, but the taxonomy of the genus *Ceratostomella* is still in a state of flux.

The importance of these organisms in causing discoloration in wood pulp has prompted work on the flora of this material, and Goidànich published a monograph on the species he found on pulp in Italy.

Less is known about the species that occur on the wood of broadleaved trees than about those on softwoods. Many of the light coloured, softer woods that are now being imported into this country from the tropics, are very liable to stain if they are left for any length of time in the jungle, and it is often necessary to spray the logs with an antiseptic solution if one wants to get them over here in a clean condition. Most of the susceptible timbers are readily attacked by bark beetles, which can introduce sap-stain fungi. There is, in fact, a close association between Ambrosia beetles and fungi, for many of these beetles derive most of their nourishment from fungal spores and mycelium, and certain species of fungi are regularly associated with certain types of beetle. Any treatment of the logs, to be successful, must therefore protect them against insect as well as against fungal attack. Experiments are now in progress in West Africa to determine the effectiveness of various solutions containing pentachlorophenol, D.D.T. and benzene hexachloride.

The association between bark beetles of the genus *Scolytus* and the organism that causes Dutch-elm disease, *Ophiostoma* (*Ceratostomella*) *ulmi*, is well known and attempts are being made to restrict the spread of the disease by controlling the insect vector.

Certain associations also exist between insects and wood-rotting fungi. Cartwright showed that the wood wasp *Sirex* carried oidia of a *Stereum* sp. in special glands near the ovipositor, and that when the eggs are laid in the wood, these oidia germinate and infect the wood before the young larvae hatch out, presumably rendering it more suitable for their nourishment. It is of course well known that many wood-boring insects such as the death-watch beetle, show a preference for decayed wood and some types occur only in rotten wood—but in most cases no definite association between one species of beetle and specific fungi has been noted.

In addition to the staining fungi, many other Ascomycetes and Hyphomycetes are commonly found, both on sound and on decayed wood. Of these, *Paecilomyces varioti* and *Trichoderma viride* are perhaps the commonest, but we are always coming across unfamiliar species and I suggest that a study of the moulds that occur on logs and sawn timber, particularly on those imported from the tropics, would provide interesting material for the student of micro-fungi. To-day we are receiving many new kinds of timber from South America and from countries such as Siam, whose fungal flora has received very little attention, and it is likely that with some of these interesting new timbers, we are importing interesting new fungi!

Unusual species are also likely to be found on wood that has been treated with wood preservatives. *Pachnocybe* (*Graphium*) *ferruginea* is often found on wood that has been brushed with creosote at some earlier date. Christensen and his colleagues have described a fungus *Hormodendron resinae* that not only tolerates a far higher concentration of creosote than any other known fungus but which can actually derive its nourishment from some of the constituents of coal tar and creosote. It is stated to occur very commonly

on pressure creosoted wood in the U.S.A., but fortunately it is without effect on the strength of the wood.

The field of research on tree and timber diseases is still largely unexplored and many important diseases of trees await proper investigation, even in this country, while in the tropics practically nothing has been done. In a climax forest of mixed species, diseases of trees may not present economic problems of immediate importance for a certain balance between hosts and pathogens may have been reached, but when large plantations of exotic species are established in a new territory, fungal diseases and insect pests may kill out the trees or render the timber crop worthless.

Whatever be the field of one's own work, one has perhaps the tendency to feel that it does not receive sufficient attention, but I think it is a matter of simple arithmetic to prove that forest pathology, both at home and in the Empire overseas receives less than its fair share of scientific investigators. In England there are but two pathologists who are devoting their whole time to studying the diseases of living trees—compare that with the scores, nay hundreds, who are studying the diseases of horticultural and agricultural crops, and I think you will agree that the forest crop, which is certainly one of the more important grown in these isles, is not receiving its fair share of attention from plant pathologists. There is, perhaps, a tendency to feel that there is not much that one can 'do about' tree diseases. True, one cannot normally spray forest trees with fungicides, or sterilize the soil in which they grow, but there is a great deal that *can* be done to *prevent* tree diseases once the conditions that predispose a tree to disease are known. For instance, butt rot, due to *Fomes annosus*, takes a heavy toll in many plantations of spruce, larch and pine. In what types of soil and situation are each of these species of trees most liable to attack? Ecological studies of the occurrence of butt rot, such as that recently made by Rishbeth, may give a clue as to how the risk of the disease can be minimized. Selection and breeding of resistant varieties of trees has been attempted only in the case of one or two trees, such as chestnut and elm, where promising results have already been obtained.

One reason why so few workers are attracted to the study of forest pathology is because such problems are seldom suggested to research students. Results of work on trees may be slow in forthcoming and a professor hesitates to suggest a problem to a candidate for Ph.D. that is unlikely to yield results in two or three years. I do suggest, however, that not all the problems in forest pathology are necessarily long-term ones. For instance, Mr Wyatt-Smith, while a research student in the Botany Department of Oxford University, carried out a most useful piece of work on the beech-bark disease. Many University Departments of Botany and Agriculture have undertaken long-term investigations of the plant pathological problems that arise in the locally grown crops—the work of our President last year, in connexion with the flax crop comes to mind at once—would it not be possible for some Departments similarly to study in co-operation with the local forest officers some of the disease problems in the woods and plantations in their vicinity?

Where it may be difficult to undertake serious investigations into the diseases of standing trees, the collection and study of the saprophytic fungi

on the felled timber would provide useful experience for students, who could be encouraged to study the successional flora of logs at various stages of decay and learn to relate the species of fungi found to the kinds of timber and its stage of decay.

In this brief survey of the history of timber pathology, I have been able only to describe some of the interesting problems that arise, but I hope that some of you will be able to extend our knowledge of the fungi that grow on wood or will encourage others to do so in parts of the Empire where no fungal forays have yet been held.

FURTHER RECORDS OF BRITISH PREDACIOUS FUNGI. I

By C. L. DUDDINGTON

Biological Laboratories, The Polytechnic, Regent Street, London

(With 3 Text-figures)

The species here recorded were collected in the course of investigations on the distribution of predacious fungi in decaying vegetable matter. With the exception of *Dactylella ellipsospora* (Preuss) Grove, they have not previously been known in Britain.

Dactylella cionopaga Drechsler in *Mycologia*, **42**, 30 (1950)

This fungus was found in a collection of the moss *Barbula intermedia* from Skelwith Bridge, Lancashire, May 1948. The mycelium consisted of straight, septate hyphae, mostly $3-4\mu$ in diameter, bearing at intervals lateral processes, usually of one to three cells, by which nematodes were captured by adhesion. In addition to these adhesive processes, hyphal networks were produced, capturing nematodes by adhesion and entanglement (Fig. 1 *a*, *b*).

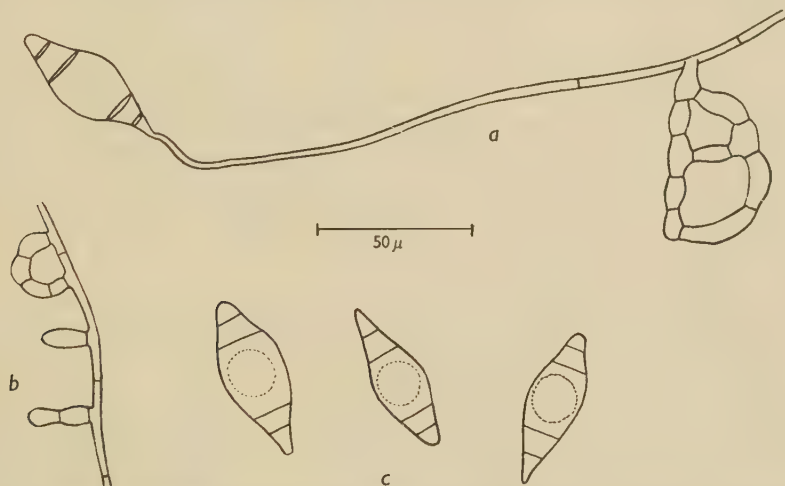


Fig. 1. *Dactylella cionopaga* Drechsler. *a*, origin of mycelium from a conidium; *b*, portion of mycelium, showing two adhesive processes and a small loop; *c*, conidia.

At the point where the nematode adhered to the fungus, a process was put out which penetrated the cuticle of the nematode and gave rise within it to a bulbous structure, the animal being by this time moribund. From this infection bulb, trophic hyphae arose, ramifying throughout the nematode and absorbing its contents (Fig. 2). There was no indication that the infection bulb was responsible for the death of the nematode.

After the fungus had captured and consumed a number of eelworms, sporulation occurred. The conidia were borne singly at the apices of erect conidiophores, mostly $250\text{--}350\mu$ high, the conidiophore sometimes branching and bearing a conidium at the apex of each branch. The conidia were ellipsoidal, measuring $40\text{--}53 \times 15\text{--}21\mu$, and usually divided by four transverse septa into five cells, of which the central one was much the largest; sometimes the conidia were four-celled (Fig. 1c). Germination of the conidium usually took place by production of a germ-tube from the proximal cell, which grew into a hypha bearing adhesive processes and networks (Fig. 1b).

By its conidial apparatus, this fungus must be referred to the genus *Dactylella* Grove. The adhesive processes recall those of *D. gephyropaga* Drechsler (1937), but the conidia are longer and the regular scalariform networks characteristic of that species are not formed. The material that I had under observation agreed very well with the description given by Drechsler (1950).

Dactylella ellipsospora (Preuss) Grove, in *J. Bot.* **24**, 200 (1886)

Syn.: *Menispora ellipsospora* Preuss in Sturm, *Dtsch. Fl.* **30**, 93, t. 47 (1851)

? *Monacrosporium leporinum* Bubák in *Ann. Mycol.* **4**, 120 (1906)

Hyphae septate, mostly $2\text{--}3\mu$ wide, bearing at intervals short, mostly unicellular processes $2\text{--}3\mu$ wide and $5\text{--}14\mu$ long; each process having at its distal end a subspherical knob $6\text{--}9\mu$ long and $5\text{--}7\mu$ wide. Nematodes are captured by adhesion to these knobs, a process from the knob penetrating the cuticle of the nematode and producing within it an infection bulb from which trophic hyphae grow out to consume the contents of the animal.

Conidia hyaline, borne singly at the apices of erect conidiophores mostly about 200μ above the substratum. Conidia $37\text{--}50\mu$ long, $11\text{--}15\mu$ in greatest diameter, five-celled, the central cell being the largest.

Occurring in a collection of bryophytes from the west bank of Beverley Brook, Wimbledon Common, January 1948.

The conidia of my collection were a little narrower than Grove's but are well within the range quoted by Drechsler (1937). The adhesive knobs were somewhat smaller than those observed by Drechsler, but the difference is not thought to be taxonomically significant.

Bubák (1906) recorded a fungus growing on hare dung which he called *Monacrosporium leporinum*. From his rather meagre description it seems likely, as Drechsler (1937) points out that this is identical with *Dactylella ellipsospora*. Unfortunately, Bubák's account is not illustrated, and without examination of his actual material the question of its identity cannot be definitely settled.

Arthrobotrys musiformis Drechsler in *Mycologia*, **29**, 477 (1937)

Hyphae septate, $3\text{--}4\mu$ in diameter, bearing at intervals networks of a rather simple type by means of which nematodes are captured by adhesion and entanglement. Infection bulb intruded by the fungus into

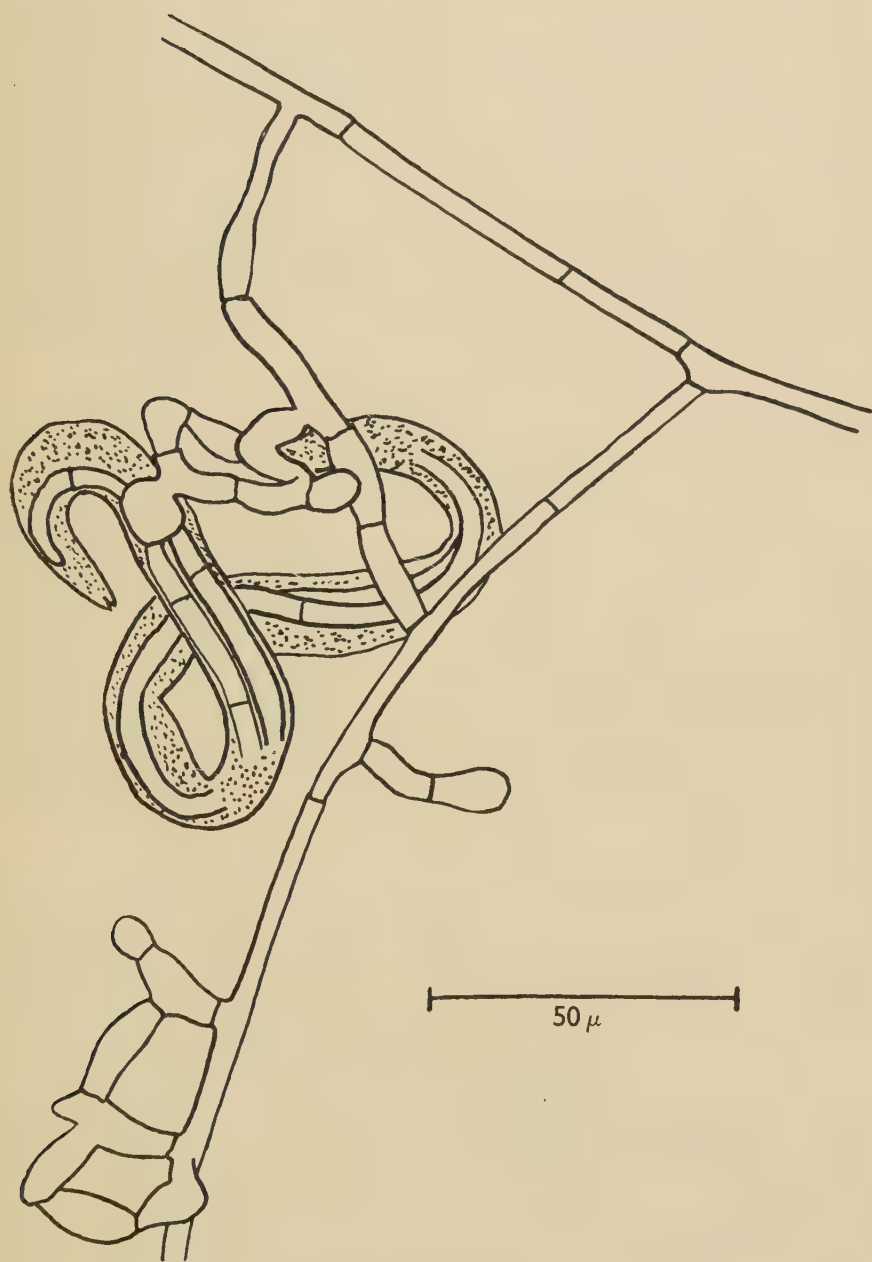


Fig. 2. *Dactylella cionopaga* Drechsler. Portion of mycelium showing networks and a captured nematode with infection bulb and trophic hyphae.

the interior of the nematode, giving rise to trophic hyphae which absorb the contents of the animal. Conidia hyaline, borne in loose heads on short sterigmata projecting from the somewhat flattened apices of the conidiophores, which rise, erect and unbranched, usually to a height of 150–350 μ above the substratum. Conidia rectangular-ellipsoidal, usually slightly curved, 31–36 $\times$ 10–12 μ , divided by a transverse septum into two cells, of which the distal one is the larger.

Occurring in leaf mould, Shelly Green Coppice, near Solihull, Warwickshire, and Barber's Coppice, Catherine de Barnes, Warwickshire, May 1944.

This elegant fungus is distinguished from most other predacious hyphomycetes by its simple networks, often consisting of a single loop, and by the loose arrangement of the conidia on the more or less expanded tip of the conidiophore.

Tridentaria implicans Drechsler in *Mycologia*, **32**, 394 (1939)

Mycelium sparse, of septate hyphae, mostly 2–4 μ wide; producing occasionally lateral branches of the same or rather greater diameter, which capture small nematodes by adhesion, and then wind round the captured nematode in one or two turns. Trophic hyphae developed from the investing hyphae which ramify within the nematode and absorb its contents. Conidia borne singly at the apices of erect conidiophores, mostly about 100 μ high. Conidia hyaline, sometimes forked into two branches, but more often divided into three branches like the prongs of a trident; overall length usually about 50 μ ; the short basal portion generally uniseptate, the prongs divided by several transverse septa.

Occurring in a collection of bryophytes from the west bank of Beverley Brook, Wimbledon Common, January 1948.

This fungus appears to be only weakly predacious. It was associated with *Dactylella ellipsospora*.

Acaulopage tetraceros Drechsler in *Mycologia*, **27**, 195 (1935)

Mycelium of slender, sparingly branched, non-septate hyphae, 1–2 μ wide. Amoebae captured by adhesion to these hyphae, capture being followed by the intrusion into the amoeba of bush-like haustoria of about the same diameter as the hyphae (Fig. 3a). These haustoria absorb the contents of the amoeba until only the shrivelled pellicle is left attached to the mycelium. Conidia hyaline, shaped like an inverted bottle, 17–26 $\times$ 7–10 μ , borne singly at the apices of short branches of the mycelium; the broad distal end of the conidium bears three to six needle-shaped empty appendages, mostly 1–2 μ wide at the base and about the same length as the conidium (Fig. 3b). Sexual reproduction was not observed.

Occurring in a collection of bryophytes from the west bank of Beverley Brook, Wimbledon Common, January 1948; and on decaying remains of *Oenothera* sp. from beneath a paving stone in a garden at Kew, Surrey, June 1948.

This attractive member of the Zoopagaceae appears to be relatively widespread, at least in the London area. It has been found in an artificial

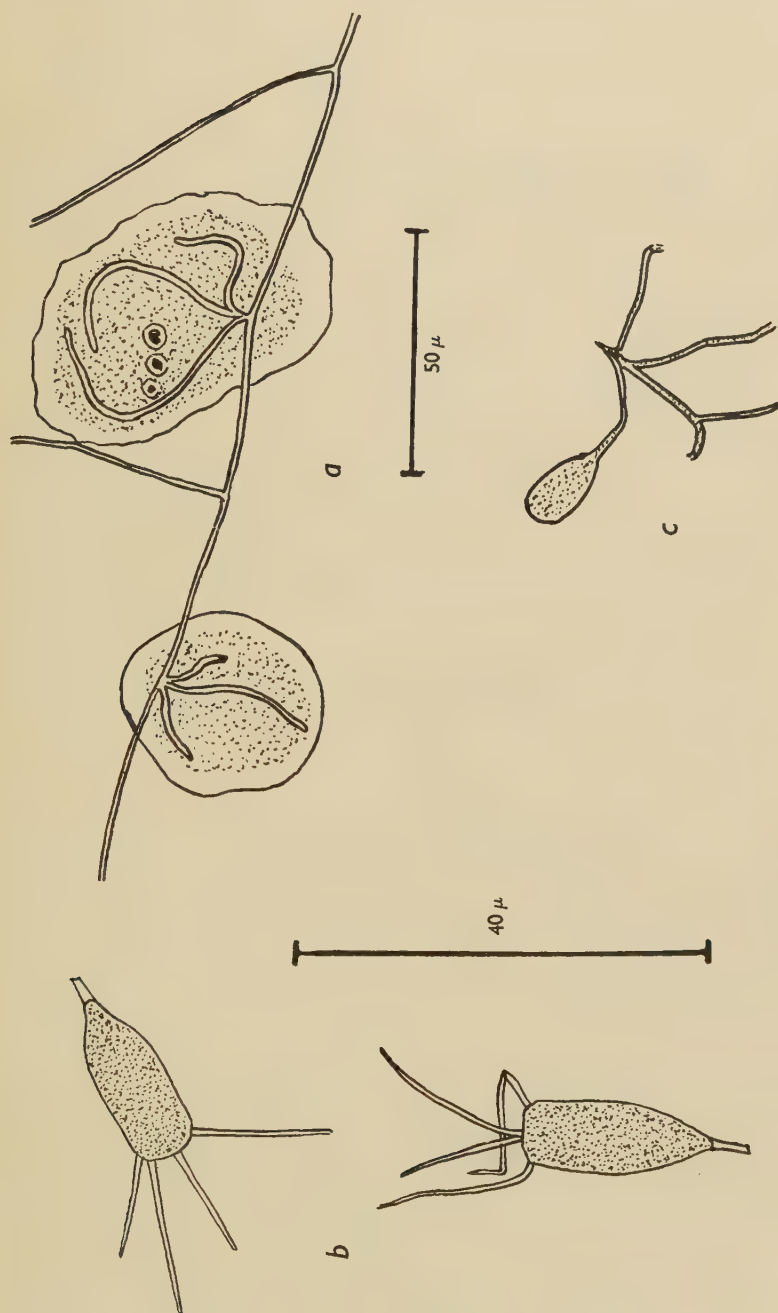


Fig. 3. *Acaulopage letracero*. a, portion of mycelium, showing two captured amoebae with haustoria; b, conidia; c, portion of mycelium with a developing conidium.

pond at Chelsea by Peach (personal communication), who has also recorded *Acaulopage dichotoma* Drechsler from an aquatic habitat (Peach, 1948).

Stylopage rhynchospora Drechsler in *Mycologia*, **31**, 394 (1939)

Mycelium slender, sparingly branched; hyphae non-septate, 1–2 μ wide. Amoebae are captured by adhesion, and their contents are absorbed by means of bush-like haustoria spreading from the point of contact, each branch about 1 μ wide. Conidia hyaline, ovoid, more or less pointed at each end, 22–36 $\times$ 7–15 μ , the distal end bearing a short, rounded beak which often becomes evacuated of cytoplasm; borne singly at the apices of erect conidiophores up to about 200 μ high, and often somewhat decumbent at the base. Conidia often germinate to form a secondary conidiophore bearing a secondary conidium. Zygospores were not observed.

Occurring amongst decomposing plant remains in a garden compost heap at Kingston-on-Thames, Surrey, March 1948.

The conidia in my collection show a slightly greater range of variation in size than those of Drechsler (1939), but the very close agreement in details of structure and habit leave no doubt of the identity of the fungus. Drechsler (1939) records that the conidia of *Stylopage rhynchospora* often stick together by means of a substance exuded from their apices. Although I had large numbers of conidia under observation, I found no sign of this.

In conclusion, I should like to record my thanks to Miss Celia Morrish for bringing me the collections from Skelwith Bridge, and particularly to Dr B. Barnes for his help and encouragement throughout the work.

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REVISION OF THE TYPES OF SOME EXTRA-EUROPEAN SPECIES OF THE GENUS *CREPIDOTUS* FR.

By ALBERT PILÁT

National Museum in Prague, Department of Botany

(With 3 Tabulae)

During my monographic study of the European species of the genus *Crepidotus* I examined in the course of years the material of this genus deposited in the largest European herbaria (Kew, Paris, Prague, Berlin and Vienna). While doing so I paid attention also to the extraeuropean species and studied especially the types which came into my hands. In the following pages I give the results of my work.

The herbarium of the Royal Botanic Gardens at Kew contains by far the largest number of types, which were lent to me for studying by the kindness of the Director and Miss E. M. Wakefield, whom I wish to thank here most cordially.

Last year (1947) R. Singer published a very interesting and valuable paper on the genus *Crepidotus* in the journal *Lilloa* ('Contributions towards a monograph of the genus *Crepidotus*', *Lilloa*, **13**, 59-65, Tucuman, 1947). Singer gives in his paper the results of his revision of the types of the species of the genus *Crepidotus*. He studied specially the species of North and South America. I, on the other hand, had the opportunity to study the types of the Old World, especially the tropical species of Asia, Africa and also Australia.

Basing myself on my investigations and using Singer's remarks on the American species I have compiled a dichotomic key for the determination of all species of the genus *Crepidotus*, which were studied in detail under the microscope, for the structure of the wall of the spores and their size are the most important characteristics of the different species of this genus, which macroscopically resemble each other considerably. In preparing the microscopic slides I crushed the lamellae in a 10% solution of KOH which gave the best results for this purpose.

Many species are of course still obscure, because the types of many of them deposited in the herbaria are insufficient and badly preserved. In such obscure cases only new, better and richer material will make possible their definite elucidation. Nevertheless, I believe that the genus *Crepidotus* Fr. is to-day one of the best known genera of the higher fungi. If it should be possible to carry out a similar study of the material also of other genera mycology would indubitably advance a big step.

I am publishing for the European species a detailed monograph of the genus *Crepidotus*, which is still in the press and will appear as volume VI of the systematic work entitled *Atlas des Champignons de l'Europe*. There I discuss also in greater detail the systematic problems and the affinities of this genus to other genera and groups of the Basidiomycetes, and determine on the

basis of a large comparative material the rich synonymics of the different species.

TYPI SPECIERUM GENERES *CREPIDOTUS* FR. EXAMINATI

Crepidotus Alpiniae (Berk.) Sacc. *Syll. Fung.* 5, 886, (1887); *Agaricus* (*Crepidotus*) *Alpiniae* Berk. in *Hook. J. Bot.* 8, 133 (1856).

Specimen originale in herbario Kewensi. Unum exemplar: Panuré, Brasilia, leg. Spruce No. 114. (Tab. I, fig. 1.)

Pileus orbiculato-reniformis, 8 mm. latus, tenuiter membranaceus, superficie haud lucidus, paulisper albotomentosus, lateraliter, breviter sed distincte stipitatus. Stipes 1 x 0.25 mm., arcuatus, paulisper tomentoso-puberulus et probabiliter dein glabrescens. Lamellae fuscae tinctu purpureo-violaceo. Sporae laeves, ellipsoideae, poro germinativo conspecto praeditae, fuscae tinctu purpureo-violaceo, $8.5 \times 5.5 \mu$. Ad plantam aliquam monocotyledonam emortuam.

Est certe *Melanotus*, probabiliter cum *Melanoto musaecola* (B. & C.) Singer identicus.

Crepidotus Auricula (Berk.) Sacc. *Syll. Fung.* 5, 889 (1887) and 9, 116; *Agaricus* (*Crepidotus*) *Auricula* Berk. in *Hook. Flor. Tasm.* 2, 246 (1860); Cooke, *Austr. Fungi*, p. 59 (1892).

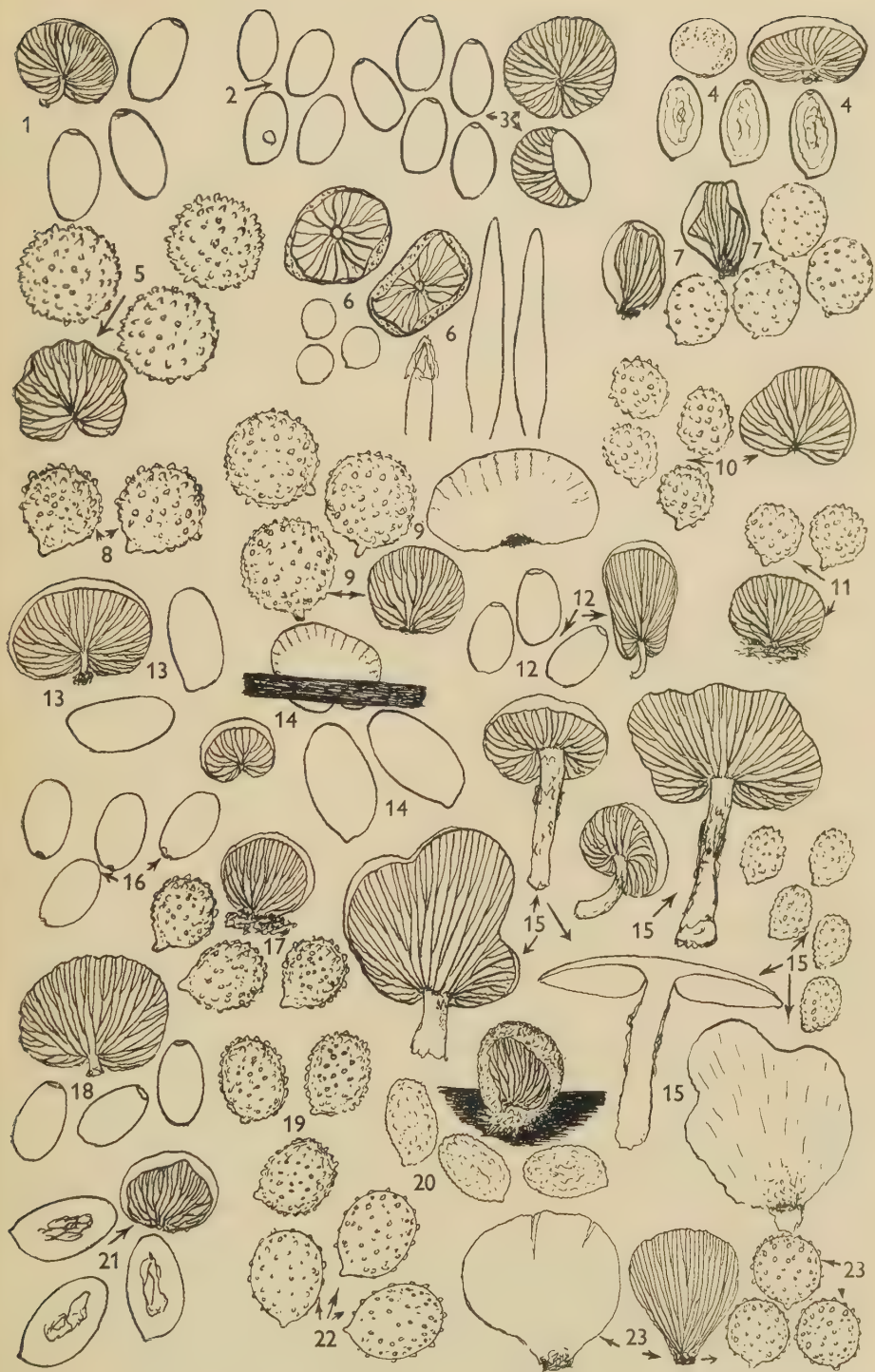
Specimen originale in herbario Kewensi: Tasmania. Unum exemplar. (Tab. I, fig. 2.)

Specimen male conservatum, qua de causa habitus fungi vix visibilis est. Ex fragmentis probabiliter pileus c. 15 mm. latus. Diagnosis teste Cooke: 'Pileus sessile, conchiform, adnate behind, cream coloured (1 in. diam.). Flesh thick, brittle when dry; margin incurved. Gills narrow, pale. Spores lentiform, 4μ long. On dead wood. Tasmania.'

Sporae in exsiccato originali ellipsoideae, laeves, conspecte pallide

Legends to Tabula I

- Fig. 1. *Crepidotus Alpiniae* (Berk.) Sacc. 2 x, sporae 1500 x.
- Fig. 2. *C. Auricula* (Berk.) Sacc. sporae 1500 x.
- Fig. 3. *C. bambusinus* Pat. 2 x, sporae 1500 x.
- Fig. 4. *C. cassiaeicolor* (Berk.) Sacc. 2 x, sporae 1500 x.
- Fig. 5. *C. citrinus* Petch. 1.5 x, sporae 1500 x.
- Fig. 6. *C. columellifer* Berk. 3 x, sporae 1500 x, cheilocystidia 750 x.
- Fig. 7. *C. crocophyllus* (Berk.) Sacc., magn. nat., sporae 1500 x.
- Fig. 8. *C. echinosporus* P. Henn., sporae 1500 x.
- Fig. 9. *C. sub epicrocinus* Pilát. Magn. nat., sporae 1500 x.
- Fig. 10. *C. episphaerius* (Berk.) Sacc. 2 x, sporae 1500 x.
- Fig. 11. *C. eumyceliatus* Kalchbr. Magn. nat., sporae 1500 x.
- Fig. 12. *C. flavo-livens* (B. & C.) Sacc. 1.5 x, sporae 1500 x.
- Fig. 13. *C. flavo-marginatus* (B. & Br.) Sacc. 1.5 x, sporae 1500 x.
- Fig. 14. *C. grumoso-pilosus* (B. & Br.) Sacc. 1.5 x, sporae 1500 x.
- Fig. 15. *C. hepaticus* (Berk.) Magn. natur. Sacc., sporae 1500 x.
- Fig. 16. *C. hepatochrous* (Berk.) Sacc., sporae 1500 x.
- Fig. 17. *C. inandae* (Cooke). Sacc Magn. nat., sporae 1500 x.
- Fig. 18. *C. insidiosus* (Berk.) Sacc. 2 x, sporae 1500 x.
- Fig. 19. *C. interceptus* (Berk.) Sacc., sporae 1500 x.
- Fig. 20. *C. leptomorphus* (Berk.) Sacc. 2 x, sporae 1500 x.
- Fig. 21. *C. leptus* (Berk.) Sacc. 3 x, sporae 1500 x.
- Fig. 22. *C. leucochrysos* (B. & C.) Sacc., sporae 1500 x.
- Fig. 23. *C. nephrodes* (B. & C.) Sacc. 1.5 x, sporae 1500 x.



TABULA I

A. Pilát ad nat. del.

ochraceae (sub microscopo fere hyalinae) $5.6 \times 3 \mu$ forma sporas *C. panuoidis* Fr. in mentem revocantes.

Crepidotus bambusinus Pat. in *J. Bot., Paris*, **5**, 309 (1891).

Specimen originale in herbario Parisiensi: Herbarium missionis Tunquini occidentalis 4464/HN/ Ke' to', 28 vii. 1890, H. Bon. (Tab. I, fig. 3.)

Pileus orbiculari-reniformis, fere non stipitatus vel stipite punctiformi, 5–12 mm. latus, superficie haud lucidus, fere puberulo-pruinosis, tenuis. Lamellae fuscae tinctu purpureo-violaceo, sat confertae. Sporae in cumulo umbrinae tinctu violaceo-purpureo, ovoideae, poro germinativo conspecto destitutae, $6-7 \times 4.5-5 \mu$, relativiter obscure fuscae tinctu violaceo-purpureo, apiculo vix visibili, laeves, absque guttis oleosis. Ad culmos putridos *Bambusae*.

Crepidotus bufonius Velenovský, *Novitates Mycologicae Novissimae*, p. 76 (1947).

Typus in herbario Musei Nationalis Praegae, No. 147338: Bohemia: Mnichovice, ad lacum Božkov, ad terram, 28. xi. 1941.

Est *Pleurotus tremulus* (Schaeff. ex Fr.) Quél.

Crepidotus Caspari Velenovský var. *alneus* Velenovský, *Novitates Mycologicae*, p. 134 (1939).

Typus in herbario Musei Nationalis Praegae, No. 147318: Bohemia, Mnichovice, ad ligna *Alni glutinosae* putrida, 14. viii. 1939.

Specimen male conservatum! Probabiliter *Pleurotus hypnophilus* Berk.

Crepidotus cassiaeicolor (Berk.) Sacc. *Syll. Fung.* **5**, 882 (1887); *Agaricus* (*Crepidotus*) *cassiaeicolor* Berk. in *Hook. Flor. Tasm.* **2**, 246 (1860); Cooke, *Austr. Fungi*, p. 59 (1892).

Typus in herbario Kewensi ex herbario M. C. Cooke 1885. Duo carposomata. Tasmania, leg. W. Archer. (Tab. I, fig. 4.)

Pileus 8–10 mm. latus, reniformis, lateraliter adnatus, prima juventute probabiliter stipite punctiformi destitutus, relativiter crasse carnosus, superficie sordide fuscus, minime puberulus. Lamellae sordide fuscae. Trama lamellarum ex hyphis paulisper gelatinosis, qua de causa lamellae sectae paulisper lucidae et quoque stratum pilei superficiale sectum paulisper lucidum est et ex hyphis ferrugineis, conferte intricatis, $3-5 \mu$ crassis constat. Trama cetera ex hyphis pallidioribus, paulisper laxius et irregulariter intricatis, lutescentibus. Pileus relativiter compactus et crasse carnosus, minus fragilis, quam species ceterae. Sporae $7.5-8.5 \times 5-5.6 \mu$, ellipsoideae, uno latere paulisper applanatae, pallide argillaceae, membrana conspecte pallida et plasma obscurius colorata instructae, poro germinativo sat distincto praeditae.

Crepidotus chimonophilus (Berk. & Br.) Sacc. *Syll. Fung.* **5**, 882, (1887); Massee, *Brit. Fungus Flora*, **2**, 120 (1893); Rea, *Brit. Basid.* p. 456 (1922). *Agaricus* (*Crepidotus*) *chimonophilus* B. & Br. in Berk. *Outl.* p. 164 (1860); Cooke, *Handbook*, p. 191, *Illustrations of Br. Fungi*, t. 515 D.

Typus in herbario Kewensi: England, Benefield, 18. xii. 1851, on *Pyrus torminalis*. Solum unum exemplar chartae agglutinatum. Icon auctoris adest.

Pileus 2 mm. diam., orbicularis, non stipitatus, uno puncto centrali et dorsali adnatus. Stratum gelatinosum superficiale ex hyphis hyalinis. Supra stratum gelatinosum reliquiae contexti lutei adsunt. Sporae ellipsoideae, paulisper amygdaliformes, luteo-ferrugineae, laeves $8.5-8.8 \times 5.5-5.8 \mu$. Has sporas ad basidia inveni. Praeterea sporas alias in preparato microscopico inveni, vel conidia huius fungi vel sporas alienas, hyalinas vel subhyalinas, ovato-globosas, verrucosas, $5.6 \times 4 \mu$.

Typus hic est carposoma admodum juvenile, potius solum primordium carposomatis, cum lamellis humilibus et sporis paucis. Verisimiliter carposoma juvenile *Crepidotis mollis* (Schaeff.) Quél.

C. chimonophilus sensu auctorum posteriorum plerumque synonymum *C. variabilis* est.

Crepidotus citri Pat. in *Bull. Soc. Mycol. Fr.*, **18**, 172 (1902).

Typus in herbario Parisiensi: in truncis Citri, Guadeloupe, Camp Jacob, vi. 1900, leg. Duss. Cf. etiam Singer in *Lilloa*, **13**, 68 (1947).

Pileus 0.5-1 cm. diam., orbicularis, habitu *C. variabilem* in mentem revocans, lamellis primum argillaceis, dein obscure ferrugineis, superficie albidus vel pallide subochraceus, glaber. Sporae globosae vel globoso-ovoideae, laeves, obscure ferrugineae, $7.5-8.5 \times 5.5-6.8 \mu$. A *C. applanato* Pers. sporis obscurioribus, laevibus et haud regulariter globosis discrepat. Singer *loc. cit.* hanc speciem cum *C. ubero* probabiliter identicam esse existimat. Murrill in ephemeride, *Mycologia*, **5**, 27 (1913), nomine '*Crepidotus citri*' fungum e insula Jamaica designavit, qui sporas ovatas $7 \times 4 \mu$ magnas habet.

Crepidotus citrinus Petch in *Ann. R. bot. Gdns. Peradeniya* **9**, 225 (1924) (non Larsen, *Fungi of Iceland, The Botany of Iceland*, **2**, 545 (1932). = *C. Larseni* Pilát n.n.)

Typus in herbario Kewensi: Ceylon, Peradeniya, leg. T. Petch, 29. viii. 1912. (Tab. I, fig. 5.)

Pileus 8-12 mm. diam., orbicularis vel reniformis, habitu *C. variabili* sat similis, dorso substrato adpressus. Lamellae fuscae. Sporae perfecte globosae et distincte denseque verrucoso-aculeatae, $8-9 \mu$ diam.

Crepidotus columellifer Berk. ined. in Herb. Kew.

Typus in herbario Kewensi: Borneo. Duo pilei. (Tab. I, fig. 6.)

Pilei 4-5 mm. diam., rotundati, dorso substrato adpressi, uno puncto centrali, verruciformi adnati, extus tomentoso-hirsuti. Lamellae sordide brunneae. Stipes abortivus, retroflexus ut verruca centralis alba, ad quam lamellae concurrunt. Sporae hyalinae, globosae, laeves, 3μ diam., sparsae. Cheilocystidia fusioideo-conica, tenuiter tunicata, nonnulla apice muricellata, $15-40 \times 5-6 \mu$. Contextus sat firmus.

Non est *Crepidotus*! Probabiliter species generis *Marasmius*.

Crepidotus crocophyllus (Berk.) Sacc. *Syll. Fung.* **5**, 886 (1887); *Agaricus* (*Crepidotus*) *crocophyllus* Berk. in *Hook. Lond. J. Bot.* **6**, 313 (1847).

Typus in herbario Kewensi: Waynesville, Ohio, leg. F. G. Lea. (Tab. I, fig. 7.)

Pileus parvus, 0.5–1 cm. latus, lateraliter substrato adnatus. Specimina male conservata. Sporae globosae, subtiliter verrucoso-punctatae, 5.8–6 μ diam. Color lamellarum originalis aegre agnoscendus.

Probabiliter specimina parva juveniliaque *C. applanati* (Pers. ex Fr.) Quél.

Crepidotus echinosporus P. Henn. in Engler, *Pflanzenw. Ostaf. Theil C*, p. 60 (1895).

Typus in herbario in Berlin-Dahlem: Kamerun, Bibundi, leg. J. R. Jungner. (Tab. I, fig. 8.)

Pileus 5–10 mm. latus, orbiculari-reniformis, obscure argillaceo-fuscus. Lamellae obscure argillaceae. Hyphae 4–7 μ crassae, tenuiter tunicatae, subhyalinae. Sporae subglobosae, 6.5–8 μ diam., conspecte aculeato-verrucosae, magis aculeatae et obscurius coloratae, quam in *C. Cesatii* Rab.

Crepidotus epibryus Fr. Quél., *Champ. de Jura et Vosges*, p. 107 (1872).

England: Weybridge, herbarium Kewense, 10. ix. 1918. Est *Pleurotus septicus* (Fr.) Quél.

Crepidotus epicrocinus (B. & Br.) Sacc. *Syll. Fung.* 5, 884 (1887); *Agaricus* (*Crepidotus*) *epicrocinus* Berk. in *J. linn. Soc. (Bot.)*, 9, 545 (1871).

Typus in herbario Kewensi: Peradeniya, Ceylon, Thwaites No. 954, xii. 1868.

Pileus rotundato-reniformis, 10–30 mm. latus, uno puncto lateraliter adnatus, lobis duobus locum insertionis amplexantibus, dein margine lobatus, superficie (praecipue juventute postice) laete croceo-aurantiaco-tomentosus, dein subglabrescens et argillaceo-ochraceus (in fungo exsiccato). Lamellae in fungo vivo probabiliter albae, in speciminibus exsiccatis pallide argillaceo-fuscae, sat distantes. Sporae globosae, apiculo sat magno instructae, humiliter sed dense et distincte verrucosae, pallide luteo-rubeolo-argillaceae vel ferrugineae, 6–7 μ diam.

Hab. Ceylon, Peradeniya, xii. 1868.

Herbarium Kewense etiam specimen Thwaitesii No. 954*b* continet, quod ut '*Crepidotus epicrocinus* Berk. & Br. var.' designatum est. Specimen commemoratum 6 carposomata continet et speciem aliam, quamquam affinem, representat. Differt sporis majoribus, perfecte globosis, apiculo verruciformi parvo instructis, subtiliter confertissimeque obtuse verrucosis, pallide rubescenti-luteo-ferrugineis. Hanc speciem sub nomine '*Crepidotus subepicrocinus* Pilát' describo.

Crepidotus episphaeria (Berk.) Sacc. *Syll. Fung.* 5, 885 (1887); *Agaricus episphaeria* Berk. in *Hook. Lond. J. Bot.* 5, 1 (1846).

Typus in herbario Kewensi: Africa australis. Duo collecta. (Tab. I, fig. 10.)

Charta prima pileos tres continet (Drege 13*b*), charta secunda pileum unum habet (Drege no. 9413*a*). Duo pilei in charta prima et pileus unicus in charta secunda speciem unam representant. Sed carposoma tertium in charta prima species generis *Melanotus* Pat. est et probabiliter cum *Melanoto musaecola* B. & C. identica.

Pileus 5–8 mm. latus, non stipitatus, habitu externo *Crepidoto variabili* Pers.

similis, sed exsiccatus colore argillaceo-fusco gaudet. Sporae globosae, cum apiculo piriformi, haud raro 'subangulatae', pallide ferrugineae, dense obtuse verrucosae, $5.5-6\ \mu$ diam., paulisper pallidius coloratae et paulisper minores et minus verrucosae, quam in *C. reverso* B. & Br. *C. episphaeria* (Berk.) probabiliter cum *C. eumyceliato* Kalchbr., *C. pogonato* (Kalchbr.) Sacc. et *C. Inandae* (Cooke) Sacc. identicus est.

Crepidotus eumyceliatus Kalchbr. ined.

Typus in herbario Friesii in Uppsala: Africa australis, Promont. Bonae Spei, leg. MacOwan. (Tab. I, fig. 11.)

Pileus $1-1.5$ cm. latus, non stipitatus, orbiculari-reniformis, uno puncto adnatus usque cupuliformis, ad mycelium albidum, tomentoso-gossypinum, superficiale insidens. Carposomata plerumque laxae gregaria. Sporae globosae, apiculo parvo instructae, pallide luteo-fuscae, indistincte verrucosae, $5-5.5\ \mu$ diam.

Cum *C. pogonato* (Kalchbr.) Sacc. identicus.

In herbario Parisiensi duo collecta sub *Agarico variabili* Pers. inveniuntur, quae ut *Crepidotum sphaerosporum* Pat. R. Maire determinavit. Specimina haec ad *C. pogonatum* probabiliter pertinent:

1. Museum Paris, Collection de Drège 9413a, Cap de Bonne Espérance.

Pileus orbiculari-reniformis, uno puncto substrato adnatus, $5-10$ mm. latus. Sporae perfecte globosae, minutissime verrucosae $5.6-5.8\ \mu$ diam., pallide fuscae.

2. Herbarium Musei Parisiensis: Herb. du Chile Austr., envoyée par M. Gay: 3me envoi: Valdivia (Chile, leg. M. Gay).

Pileus $4-8$ mm. latus, orbicularis, uno puncto fere laterali ad mycelium superficiale insidens. Sporae fere perfecte globosae, apiculo paulisper piriformi instructae, paulisper obscurius coloratae et magis verrucoso-aculeatae, quam in *C. applanato* esse solent, $6\ \mu$ diam.

Crepidotus exoticus Velenovský, *Mykologia, Praga*, 6, 66 (1929).

Typus in herbario Musei Nationalis Pragae, No 147, 322: Praga, hortus botanicus universitatis, in tepidario palmarum, viii. 1927, leg. Velenovský.

Specimina sterilia! Fungus hic probabiliter ad *Clitopilum chioneum* Pers. pertinet.

Crepidotus flavo-livens (Berk. & Curt.) Sacc. *Syll. Fung.* 5, 887 (1887); *Agaricus* (*Crepidotus*) *flavo-livens* B. & C. in *Proc. Amer. Acad. Arts Sci.* 4, 117 (1858).

Typus in herbario Kewensi: Insulae Bonin, unum exemplar! (Tab. I, fig. 12.)

Pileus 5 mm. latus, rotundato-protractus, superficie subtiliter adpresse tomentosus, albidus, stipite valde excentrico usque fere laterali, 1.5 mm. longo, sed distincto arcuato instructus. Lamellae confertae, fuscae tinctu rubro-violaceo. Sporae ellipsoideae, laeves, poro germinativo distincto instructae, ferrugineo-fuscae tinctu purpureo-violaceo, $6-7 \times 5-5.2\ \mu$. Est *Melanotus musaecola* (B. & C.) Singer.

Crepidotus flavo-marginatus (Berk. & Br.) Sacc. *Syll. Fung.* 5, 884 (1887);
Agaricus (*Crepidotus*) *flavo-marginatus* B. & Br. in *J. linn. Soc. (Bot.)*, 11, 546
 (1871).

Typus in herbario Kewensi: Ceylon, leg. Thwaites No. 392. Unum exemplar! (Tab. I, fig. 13.)

Pileus 10 mm. latus, stipite exiguo, laterali instructus, orbiculari-reniformis, ferrugineus probabiliter paulisper tomentosus. Lamellae laete luteo-ferrugineae. Stipes 1.5 mm. longus, arcuatus, basi et apice (sub lamellis) luteolo-tomentosus. Lamellae in solutione KOH colorem luteum emittent. Sporae late ellipsoideo-phaseoliformes, fere absque apiculo, uno latere paulisper applanatae, laeves, in aqua pallide luteo-ferrugineae, in solutione KOH laete obscure ferrugineae tinctu rubeolo.

Fungus hic *C. hibernianus* Pearson affinis videtur, qui relationes ad *Naucoria*s et *Flammulas* ostendat.

Crepidotus Fraxini Velenovský, *Novitates Mycologicae*, p. 135 (1939).

Est probabiliter *Pleurotus applicatus* Batsch.

Crepidotus grumoso-pilosus (Berk. & Br.) Sacc. *Syll. Fung.* 5, 884 (1887);
Agaricus (*Crepidotus*) *grumoso-pilosus* B. & Br. in *J. linn. Soc. (Bot.)*, 11, 546
 (1871).

Typus in herbario Kewensi: Ceylon, leg. Thwaites No. 954a: 4 specimina. (Tab. I, fig. 14.)

Specimen originale 4 exemplaria continet, quorum tria prima ad unam speciem pertinent, quartum autem speciem diversam representat, quae cum *C. truncato* Petch identica est. Sporae in herbario Kewensi delineatae ellipsoideae sunt et ad speciem primam pertinent—qua de causa hanc speciem pro typum *C. grumoso-pilosi* (B. & Br.) Sacc. teneo—quamquam nomen specificum 'grumoso-pilosus' ad specimen quartum spectat, quod cum *C. truncato* Petch identicum est.

Pilei 4-11 mm. lati, orbiculato-reniformes, plus minus uno puncto laterali adnatae et dorso ex parte substrato adpressi, superficie albido-isabellini, probabiliter glabri, ad marginem paulisper crenato-sulcati (paulisper sublobulati?). Lamellae argillaceo-fuscae. Sporae ellipsoideae, ferrugineae, laeves, apiculo minimo instructi, absque poro germinativo, $9.5-10.5 \times 6-6.5 \mu$. Trama ex hyphis hyalinis, $5-7 \mu$ crassis, tenuiter tunicatis, sat paulum lucem frangentibus, absque strato gelatinoso. Specimen quartum, quod cum *C. truncato* Petch identicum est: pileus flabelliformis, adultus lateraliter adnatus et etiam dorso ex parte substrato affixus, 25 mm. latus, superficie isabellinus et pilis grumosis tomentoso-verrucoso-squamulosus. Hae squamulae probabiliter e cute disrupta oriuntur. Sporae perfecte globosae, apiculo parvo verruciformi instructae, subtiliter et obtuse verrucoso-punctatae, una gutta oleosa instructae, $5.7-7.5 \mu$ diam. Sporae forma et dimensionibus cum sporis speciminis originalis *Crepidoti truncati* Petch (in herbario Kewensi: Peradeniya, Ceylon 19. xii. 1914) concordant, solum *C. truncatus* Petch sporas paulisper distinctius verrucoso-punctatas habet. Cf. *C. truncatus* Petch.

Crepidotus hepaticus (Berk.) Sacc. *Syll. Fung.* 5, 879 (1887); *Agaricus* (*Crepidotus*) *hepaticus* Berk. in *Hook. Lond. J. Bot.* 6, 486 bis (1847).

Typus in herbario Kewensi: Ceylon no. 52. (Tab. I, fig. 15.)

Carposomata stipitata. Pileus 1.5–2.5 cm. latus vulgo excentricus, modice convexus vel subplano-umbilicatus, fuscus. Stipes e subcentrali valde excentricus, 1.5–2 cm. longus, c. 5 mm. crassus, cylindraceus, superficie asper (fragmenta veli partialis??). Fungus exsiccatus fragillimus. Lamellae ferrugineae, sat confertae. Sporae breviter ellipsoideo-subamygdaliformes, sat obscure ferrugineo-fuscae, aspere verrucosae, apiculo distincto munitae, $5.5 \times 3.2\text{--}4\mu$.

Cetera duo exemplaria in herbario Kewensi ut *C. hepaticus* (Berk.) Sacc. (Alagalla, vii. 1917) determinata eandem speciem representant. Stipes centralis usque conspecte excentricus, haud raro sublateralis. Pileus sordide ferrugineus, irregularis, margine lobato-sinuosus, sat tenuiter carnosus. Lamellae ferrugineae, subconfertae et angustae. Sporae ut in specimine Berkeleyano. Pars pilei cum lamellis saepe cum stipite coniuncta est. Hic fungus probabiliter haud in genus *Crepidotus* Fr. pertinet—verisimiliter potius in genus *Pholiota-Rozites*—quamquam velum partiale haud distincte evolutum sit inserendus.

Crepidotus hepatochrous (Berk.) Sacc. *Syll. Fung.* 5, 877 (1887); *Agaricus* (*Crepidotus*) *hepatochrous* Berk. in *Hook. Lond. J. Bot.* 7, 574 (1848); Cooke, *Austr. Fungi* p. 58 (1892).

Typus in herbario Kewensi: Tasmania, Herb. Berkeley, No. 756. (Tab. I, fig. 16.)

Typus, quamquam male conservatus, cum diagnose originali sat bene concordat. Pileus 1–2 cm. latus lamellis ad substratum (corticem) adpressus, in statu vivo probabiliter horizontalis, subcarnosus, laevis, fuscus. Sporae ellipsoideo-ovoidae, sat obscure argillaceae, apice truncatae (porus germinativus?), laeves, eguttulatae vel una gutta oleosa praeditae, $6\text{--}6.7\text{--}7 \times 5.3\text{--}5.6\mu$. Trama pilei ex hyphis pallide subfuscis, tenuiter tunicatis, 5–8 μ crassis, irregulariter sat conferte intricatis. Superficies pilei est hyphis similibus, obscurius fusce coloratis. Stratum gelatinosum haud evolutum est.

Crepidotus Inandae (Cooke) Sacc. *Syll. Fung.* 9, 116 (1891); *Agaricus* (*Crepidotus*) *Inandae* Cooke in *Grevillea*, 14, 6 (1890).

Typus in herbario Kewensi: Africa australis, Natal, Inanda, leg. J. M. Wood No. 680. Tria exemplaria. (Tab. I, fig. 17.)

Pileus 8–12 mm. latus, forma *C. variabilem* Pers. in mentem revocans, non stipitatus, orbicularis, uno puncto fere laterali adnatus, superficie tomentosus, pallide argillaceo-fuscus. Lamellae argillaceo-fuscae. Pileus ad mycelium superficiale, sordide albido-subfuscum insidet. Sporae globosae, in apiculum conspectum paulisper piriformiter contractae, ferrugineae, distincte conferte obtuse verrucosae, haud raro paulisper 'angulatae', $7.5\text{--}8 \times 5.5\text{--}6.5\mu$.

Cum *C. pogonato* (Kalchbr.) Sacc. identicus!



TABULA II

A. Pilát ad nat. del.

Crepidotus insidiosus (Berk.) Sacc. *Syll. Fung.* 5, 882 (1887); *Agaricus* (*Crepidotus*) *insidiosus* Berk. in *Hook. Lond. J. Bot.* 7, 574 (1848); *Flora Tasm.* 2, 246; Cooke, *Austr. Fungi*, p. 59 (1892). (Tab. I, fig. 18.)

Typus in herbario Kewensi: Penquite, Tasmania. Duo exemplaria.

Pileus 8–12 mm. latus, orbicularis, stipite laterali exiguo, arcuato, fere punctiformi praeditus, superficie glaber, haud lucidus, vivus probabiliter albidus. Sporae ellipsoideae, fuscae tinctu purpureo-violaceo, poro germinativo conspecto praeditae, laeves, $7-8.5 \times 4-4.5 \mu$. Est *Melanotus musaecola* (B. & C.) Singer.

Crepidotus interceptus (Berk.) Sacc. *Syll. Fung.* 5, 878 (1887); *Agaricus* (*Crepidotus*) *interceptus* Berk. in *Hook. Flor. Tasm.* 2, 246 (1860); Cooke, *Austr. Fungi*, p. 58 (1892).

Typus in herbario Kewensi: Tasmania. (Tab. I, fig. 19.)

Materialia in herbario Kewensi male conservata sunt. Habitus pilei indistinctus. Sporae hyalinae, id est membrana hyalina et plasma subhyalina, sed minime subbrunnea, praeditae, globosae usque fere ovoideae, distincte verrucosae, $7-8 \times 6.5-7 \mu$, sporas *C. cesatii* Rab. in mentem revocantes, sed magis globosae. Aut carposomata juvenilia et sporae immaturae, aut hic fungus in genus *Rhodotus* pertinet. Diagnosis auctoris id haud excludit 'Reniform, ochraceous white. Pileus of three strata, the middle one white interposed between two darker ones (25 mm. broad), stem very short, lateral. Spores $7-8 \mu$ long. On bark. Tasmania.'

Crepidotus Juniperi Velenovský, *Novitates Mycologicae Novissimae*, p. 77 (1939).

Typus in herbario Musei Nationalis Praegae, No. 147334: Bohemia, Mnichovice, Quercetum, ad viam Ondřejov, 20. vii. 1940, leg. Velenovský. Est *Clitopilus chioneus* (Pers.) Pilát.

Crepidotus leptomorphus (Berk.) Sacc. *Syll. Fung.* 5, 889 (1887) and 9, 117, 1891; *Agaricus* (*Crepidotus*) *leptomorphus* Berk. in *Hook. Flor. Tasm.* 2, 246 (1860); Cooke, *Austr. Fungi*, p. 59 (1892).

Typus in herbario Kewensi: Tasmania. Unum exemplar. (Tab. I, fig. 20.)

Pileus orbiculari-reniformis, latere adnatus, tomento byssoideo albedo substrato insidens, 5 mm. latus, superficie parce tomentoso-pilosus, argillaceo-isabellinus. Sporae ellipsoideae, parum indistincteque verrucosae, apiculo exiguo praeditae, pallide argillaceo-fuscae.

Legends to Tabula II

- Fig. 24. *Crepidotus malachius* (B. & C.) Sacc. $\frac{3}{4}$ magn. nat., sporae $1500 \times$.
 Fig. 25. *C. musaecola* (B. & C.) Sacc. $1.5 \times$, sporae $1500 \times$.
 Fig. 26. *C. pactolus* Cooke, $\frac{3}{4}$ magn. nat., sporae $1500 \times$.
 Fig. 27. *C. parasiticus* Mass. Magn. orig., sporae $1500 \times$, cheilocystidia $800 \times$.
 Fig. 28. *C. pecten* (B. & C.) Sacc. $1.5 \times$, sporae $1500 \times$.
 Fig. 29. *C. pezizula* (B. & Br.) Sacc. $5 \times$, sporae $1500 \times$.
 Fig. 30. *C. phaeophyllus* (Berk.) Sacc. Magn. nat., sporae $1500 \times$.
 Fig. 31. *C. phaeton* (Cooke & Massee) Sacc., Magn. nat. sporae $1500 \times$.
 Fig. 32. *C. pogonatus* (Kalchbr.) Sacc., $1.5 \times$, sporae $1500 \times$.
 Fig. 33. *C. proteus* (Kalchbr.) Sacc. $1.5 \times$, sporae $1500 \times$.
 Fig. 34. *C. putrigenus* (B. & C.) Sacc. sporae $1500 \times$.
 Fig. 35. *C. pyrrhus* (B. & C.) Sacc. $1.5 \times$, sporae $1500 \times$.
 Fig. 36. *C. reversus* (B. & Br.) Sacc. $5 \times$, sporae $1500 \times$.
 Fig. 37. *C. ridleyi* Mass. $3 \times$, sporae $1500 \times$.
 Fig. 38. *C. rubi* (Berk.) Sacc. Magn. nat., sporae $1500 \times$.
 Fig. 39. *C. stromaticus* (C. & M.) Sacc. $1.5 \times$, sporae $1500 \times$.

Crepidotus leptus (Berk.) Sacc. *Syll. Fung.* **5**, 885 (1887); *Agaricus* (*Crepidotus*) *leptus* Berk. in *Hook. Lond. J. Bot.* **4**, 46 (1845); Cooke, *Austr. Fungi*, p. 59 (1892).

Typus in herbario Kewensi: Australia, Swan River, Drummond 299. Quinque carposomata. (Tab. I, fig. 21.)

Pileus 3–5 mm. latus, fere lateraliter adnatus usque paulisper effuso-reflexus, exsiccatus argillaceo-fuscus, superficie paulisper tomentosus. Lamellae argillaceo-fuscae, relativiter satis carnosae. Sporae laeves, plasmas nebulosam habentes, ellipsoideae, absque poro germinativo, $8.4-9 \times 5.5-6 \mu$. Habitu sat *C. cassiaecolorem* (Berk.) Sacc. in mentem revocat, sed sporis paulisper discrepat.

Crepidotus leucochrysos (Berk. & Curt.) Sacc. *Syll. Fung.* **5**, 887 (1887); *Agaricus* (*Crepidotus*) *leucochrysos* B. & C. in *Proc. Amer. Acad. Arts Sci.* **5**, 117 (1858).

Typus in herbario Kewensi: Insulae Bonin. (Tab. I, fig. 22.)

Singer existimat hanc speciem solum formam *Crepidoti nephrodis* esse. Certe *C. applanato* Pers. affinis est, sed sporis paulisper discrepat. Sporas haud perfecte globosas, sed paulisper piriformes, apiculo distincto et depressione hilari praeditas habet. Etiam paulisper majores, $8-8.5 \times 5.6-5.9 \mu$ sunt et probabiliter membranam magis verrucosam et colorem obscuriorem habent. In herbario Kewensi duo carposomata adsunt, quae chartae agglutinata sunt. Pileus 1–1.3 cm. latus, flabelliformis, ad basin paulisper cuneato-angustatus, tenuiter membranaceo-carnosus, superficie glaber et radialiter sulcatus.

Crepidotus lingulatus Velenovský, *Mykologia, Praga*, **6**, 66 (1929).

Est *C. panuoides* (Fr.) Pilát (in *Atlas des Champignons de l'Europe*, **6**, 17 (1948)).

Crepidotus malachius (Berk. & Curt.) Sacc. *Syll. Fung.* **5**, 883 (1887); *Agaricus* (*Crepidotus*) *malachius* B. & C. in *Ann. Mag. nat. Hist.* ser. 3, **4**, 291 (1859).

Typus in herbario Kewensi: 5730, New England, leg. Sprague. Icon collectoris ad fungum vivum delineatus adest. (Tab. II, fig. 24.)

Specimen originale et icon optime cum *Crepidoto applanato* (Pers. ex Fr.) Karst. concordat! Sporae perfecte globosae, subtiliter verrucoso-punctatae, apiculo verruciformi praeditae, argillaceo-fusco-ferrugineae, $6-7 \mu$ diam.

Crepidotus melleus (B. & Br.) Petch in *Ann. R. bot. Gdns. Peradeniya*, **9**, 223 (1924) (*Aschersonia mellea* B. & Br.). Coll. T. Petch, No. 5172 in herbario Kew. Peradeniya, Ceylon, 11. 1917.

Unum specimen solum visum. Pileus $4\frac{1}{2}$ cm. diam., subtenuiter carnosus, flabelliformis-reniformis, lateraliter adnatus, margine subundulato-lobulatus, exsiccatus ochraceus, parte basali paulisper albidotomentosus, glaber, cute lucida, in statu vivo verisimiliter subviscida. Caro alba. Lamellae mediocriter latae, subconfertae, in fungo exsiccato argillaceae. Sporae ellipsoideo-subamygdaliformes, $8-9 \times 5.5-5.7 \mu$, nonnullis guttulis parvis instructae, laeves, sub microscopio argillaceo-luteae.

Aschersonia mellea B. & Br. in *J. linn. Soc. (Bot.)*, **14**, 89 (1873).

Type material in herbario Kew.: Thwaites 730, Ceylon.

Solum unum carposoma visum, juvenile, immaturum, 4 mm. diam., reniformiter-semiorbiculare, convexum, uno puncto laterali adnatum, in statu exsiccatum lucidum, vivum probabiliter subviscidum, ochraceum. Lamellae in fungo exsiccatum argillaceo-brunneae. Sporae haud numerosae (specimen juvenile!), ellipsoideo-subamygdaliformes, laeves, argillaceo-subferrugineae, tinctu debili purpurascenti, $8.5-9 \times 5.5-6 \mu$.

Probabiliter specimen juvenile speciei praecedentis, *Crepidoti mellei* (B. & Br.) Petch. no. 5172.

Sporae dimensionibus et forma in speciminibus ambis bene concordant, sed color sporarum sub microscopio in specimine Thwaites No. 730 paulisper purpurascens est. Probabiliter ambo specimina ad speciem unam pertinent.

C. melleus sensu Petch. (loc.cit. p. 223.) *C. grumoso-piloso* (B. & Br.) Sacc. affinis est. Forma et dimensionibus sporarum ambo fungi sat bene concordant. Specimen originale *C. grumoso-pilosi* (B. & Br.) Sacc. Thwaites 954a quatuor carposomata continet, quorum specimina I-III typum, specimen quartum contra *C. truncatum* Petch representat.

Petch (loc. cit. p. 224) in diagnose *C. grumoso-pilosi* B. & Br. superficiem pileorum paulisper alio modo describit, quam in specimine originali commemorato observavi. Sed dimensiones sporarum concordant. Specimina originalia sat male conservata sunt et ideo difficile dictum utrum *C. melleus* cum *C. grumoso-piloso* identicus sit, an species diversas representat. Herbarium Thwaites No. 954 specimina ut sequitur continet:

No. 954a: quatuor carposomata, quorum I-III typum *C. grumoso-pilosi* B. & Br. representant et specimen IV ad *C. truncatum* Petch. pertinet.

No. 954b: specimina originalia *C. subepicrocini* Pilát.

No. 954: specimina originalia *C. epicrocini* (B. & Br.) Sacc. Haec species *C. truncato* Petch affinis est, sed colore et pilei superficie discrepat. Sporae in speciebus ambis commemoratis sat similes sunt.

Crepidotus musaecola (Berk. & Curt.) Sacc. *Syll. Fung.* **5**, 883 (1887); *Agaricus* (*Crepidotus*) *musaecola* B. & C. in *J. linn. Soc. (Bot.)*, **10**, 291 (1868); *Melanotus musaecola* (B. & C.) Singer in *Lloydia*, **9**, 130 (1946).

Typus in herbario Kewensi: Cuba, leg. Wright, No. 86. (Tab. II, fig. 25.)

Sporae ellipsoideae, fuscae tinctu purpureo-violaceo, poro germinativo conspecto praeditae, $8.5 \times 5.6 \mu$. Pileus 4-10 mm. latus, stipite exiguo laterali, fere punctiformi praeditus, dein saepe uno puncto laterali adnatus, haud raro etiam pars pilei dorsalis substrato adnata est. Superficies pilei subglabra, albidula vel sublutescens. Lamellae obscure fuscae tinctu purpureo-violaceo.

Specimen secundum huius speciei in herbario Kewensi sub *Crepidoto molli* Schaeff. invenitur (Cuba, leg. C. Wright). Adnotatio postera apud exsiccatum adest: 'Probably *C. musaecola*, see *Mycologia*, **5**, 27'.

Pileus 1-1.5 cm. latus, orbiculari-reniformis, fere absque stipite uno puncto laterali adnatus, forma fere carposomata majora *Pleuroti applicati* Batsch in mentem revocans. Lamellae confertae, humiles, obscure coloratae. Pileus exsiccatum sordide fuscus. Sporae ferrugineo-fuscae tinctu debili

purpureo-violaceo, poro germinativo parvo et parum distincto munitae, ellipsoideae, $8-8.5 \times 5.5 \mu$.

Crepidotus nephrodes (Berk. & Curt.) Sacc. *Syll. Fung.* 5, 882 (1887); *Agaricus* (*Crepidotus*) *nephrodes* B. & C. in *Ann. Mag. nat. Hist.* ser. 2, 12, 422 (1853).

Typus in herbario Kewensi: Carolina Inferior, leg. Ravenel. Tria carposomata! (Tab. I, fig. 23.)

Specimen originale cum europaeo *Crepidoto applanato* Pers. habitu concordat. Solum sporae paulisper minus distincte verrucoso punctatae sunt.

Pileus adultus fere absque stipite uno puncto laterali adnatus, suborbiculari-flabelliformis, superficie albidus et glaber, 1.5-3 cm. latus. Lamellae pallide argillaceo-fuscae. Sporae perfecte globosae, apiculo verruciformi parvo munitae, parum distincte verrucoso-punctatae, $5.5-6.5 \mu$. Probabiliter specimina juvenilia *C. applanati* (Pers. ex Fr.) Karst. Haec species americana item crescit ad caudices humidos emarcidos, ut *C. applanatus* europaeus. Teste Singer species identicae sunt: *C. putrigenus* (B. & C.) Sacc., *C. malachius* (B. & C.) Sacc. et *C. palmularis* (B. & C.) Sacc.

Crepidotus niveus Velenovský, *Novitates Mycologicae Novissimae*, p. 76 (1947).

Typus in herbario Musei Nationalis Praegae, No. 147.339: Bohemia, Mirošovice prope Mnichovice, in palude, 15. x. 1942, ad caules herbarum leg. J. Velenovský.

Specimen secundum in herbario Musei Nationalis Praegae, No. 147.333: Bohemia, Mnichovice, ad caules Ulmariae in palude ad viaductum viae ferreae, 30. x. 1942, leg. J. Velenovský.

Ambo collecta identica sunt. Est *Pleurotus septicus* (Fr.) Quél.!

Crepidotus odoratus Velenovský, *Novitates Mycologicae Novissimae*, p. 76 (1947).

Typus in herbario Musei Nationalis Praegae, No. 147321: Bohemia, Mnichovice, Larices in pomariis publicis, viii. 1940, leg. J. Velenovský.

Est *Lactarius* sp.

Crepidotus pactolus Cooke ined. in Herb. Kew.

Specimen typicum in herbario Kewensi: Omeo (Victoria, Australia) leg. J. Stirling. (Tab. II, fig. 26.)

(Solum pars unius carposomatis visum)

Pileus cuneato-flabelliformis, 4.5 cm. longus et 3 cm. latus, superficie haud lucidus, sed subglaber, minime tomentosus, obscure ferrugineo-fuscus. Lamellae obscure ferrugineo-fuscae, confertae. Habitu sat carposomata *C. panuoidis* in mentem revocat. Sporae cylindraceo-subfusioideae, laeves, luteo-ferrugineae, $14-15 \times 5.6-6 \mu$, forma sporas Boletorum in mentem revocantes. Lamellae speciminis originalis pro dolor pressae sunt. Forma sporarum haec species in affinitatem generis *Phylloporus* spectat, quamquam habitus carposomatis alius est et magis *Crepidotum panuoidem* in mentem revocat.

Crepidotus parasiticus Mass. ined. in Herb. Kew.

Typus in herbario Kewensi: Tasmania, ad truncum vivum *Eucalypti obliquae*. Solum dimidium unius pilei visum! (Tab. II, fig. 27.)

Pileus 30–40 × 15 mm., late semiorbicularis, fere uno puncto lateraliter insidens, conferte et sat crasse carnosus, alutaceo-fuscus, praecipue parte media dense obscurius setaceo-squamulosus (hyphae piliformes conos breves formant), parte basali potius ochraceo-tomentosus, etiam parte marginali solum subtiliter tomentosus. Lamellae luteo-cinnamomeae, sat latae, subdistantes. Caro pilei usque 4 mm. crassa, in specimine exsiccato albidolutescens, subsuberosa. Stratum gelatinosum nullum. Sporae elongato-ellipsoideae, subamygdaliformes vel usque subphaseoliformes, nonnullae apice paulisper angustato-protractae, forma sat variantes, poro germinativo indistincto, apiculo vix evoluto, luteo-fuscae, plasma granulosa cum plurioribus guttulis oleosis, laeves, $10.5-11.5 \times 7.8-8.2 \mu$. Basidia hyalina, tenuiter tunicata, tetrasterigmatica, $20-25 \times 7.5-8.5 \mu$. Cheilocystidia acie lamellarum sat copiosa, anguste sublageniformia, apice haud raro subcapitato-clavata, forma sat variantia, tenuiter tunicata, maturitate nonnullae cum plasma luteola, $25-40 \times 6-8.5 \mu$. Lamellae sat crassae. Trama earum haud bilateralis. Subhymenium distincte evolutum, ex hyphis coralliformibus. Ad truncum vivum *Eucalypti obliquae*. Tasmania. Species insignis—probabiliter ad *Flammula* spectans.

Crepidotus pecten (Berk. & Curt.) Sacc. *Syll. Fung.* 5, 885 (1887); Murrill, *North Amer. Flora*, 10, 152 (1917); *Agaricus* (*Crepidotus*) *pecten* B. & C. in *Ann. Mag. nat. Hist.* ser. 3, 4, 291 (1859).

Typus in herbario Kewensi: Carolina australis No. 4991. (Tab. II, fig. 28.)

Pileus 3–10 mm. latus, orbicularis, dorso substrato adpressus, superficie fibrilloso-tomentosus, in fungo exsiccato fuscus. Lamellae argillaceo-fuscae, tincto debili olivaceo, sat obscure et triste coloratae. Sporae globoso-ovoideae, sat pallide argillaceo-fuscae, laeves, apiculo parvo instructae, absque poro germinativo, plasma nebulosa repletae, $9-9.3 \times 6.5-7 \mu$.

Crepidoto Lundellii var. *subglobisporo* Pilát affinis, sed sporis majoribus et obscurius coloratis discrepat.

Crepidotus Peteauxii (Quél.) Quél. *Ench.* p. 108 (1886).

Species incerta. Specimen in herbario Musei Nationalis Pragae, No. 149007: Bohemia: Krč prope Pragam, in gramine, leg. A. Doubová, 4. viii. 1945, determinavit V. Vacek—*Pleurotum septicum* (Fr.) Quél. continet.

Crepidotus pezizula (Berk. & Br.) Sacc. *Syll. Fung.* 5, 884 (1887); *Agaricus* (*Crepidotus*) *pezizula* B. & Br. in *J. linn. Soc. (Bot.)*, 14, 32 (1873).

Typus in herbario Kewensi: Ceylon, leg. Thwaites No. 395. (Tab. II, fig. 29.)

Species exigua. Pileus solum 1.5–2.5 mm. latus, conchiformis usque subcupuliformis, extus albo-pilosus. Lamellae pallide ochraceo-fuscae. Ad ramulos tenues occurrit. Habitu paulisper *Crepidotum Wakefieldiae* Pilát in mentem revocat. Sporae laeves, argillaceo-fuscae, sat pallide coloratae, ellipsoideae, paulisper amygdaliformes, apiculo sat distincto sublaterali munitae, forma sat variabiles, haud raro paulisper uti subangulatae, $8.5-9 \times 5.7-6 \mu$.

Crepidotus phaeophyllus (Berk.) Sacc. *Syll. Fung.* **5**, 885 (1887); *Agaricus* (*Crepidotus*) *phaeophyllus* Berk. in *Hook. Lond. J. Bot.* **6**, 486 bis (1847).

Typus in herbario Kewensi: Ceylon, Hautane Range, **6**. 1844, leg. Gardner. Capsula duo specimina habet (an e duabus localitatibus?) sed ambo eidem speciei pertinent. (Tab. II, fig. 30.)

Pileus 20–40 mm. latus, suborbicularis, margine lobato-sinuosus, uno puncto laterali adnatus, vix stipitatus, extus pallide ochraceus, glaber. Lamellae sordide argillaceo-fuscae. Sporae ellipsoideae, fuscae tinctu purpureo-violaceo, laeves, poro germinativo distincto praeditae $8.5 \times 5.5 \mu$. Specimen secundum manuscripto cel. Berkeley ut '*Agaricus phaeophyllus* Berk., Peradeniya, Ceylon, common, July-December' designatum modo macro-et microscopico certe identicum est.

Crepidotus phaeophyllus Berk. ad genus *Melanotus* Pat. pertinet. Forma et dimensionibus sporarum cum *M. musaecola* (B. & C.) Singer bene concordat, sed dimensionibus pilei majoribus paulisper discrepat. An solum specimina adulta et magna *M. musaecolae* (B. & C.) Singer?

Crepidotus phaeton (Cooke & Masee) Sacc. *Syll. Fung.* **9**, 116 (1891); *Agaricus* (*Crepidotus*) *phaeton* C. & M. in *Grevillea*, **15**, 99 (1887); Cooke, *Austr. Fungi*, p. 57, 1892.

Typus in herbario Kewensi: Australia, near Melbourne 1886. Solum unum carposoma, male conservatum. (Tab. II, fig. 31.)

Fungus probabiliter terrestris, stipite laterali, erecto, 25 mm. longo et 3–4 mm. crasso, cylindraceo, basi paulisper incrassato, paulisper fibrilloso-rimoso. Pileus reniformis, rotundatus, probabiliter paulisper infundibuliformiter contortus, 30×25 mm. magnus, laevis glaberque, exsiccatus nigrofuscus, vivus verisimiliter tenuiter membranaceo-carnosus. Lamellae densae et sat angustae, in fungo exsiccato sordide obscure fuscae. Sporae ellipsoideae, uno latere paulisper applanatae, laeves, absque apiculo distincto, plasma 'coagulata' praeditae, $8-9.5 \times 5.5-6 \mu$, ferrugineae.

Habitu hic fungus a ceteris speciebus *Crepidotorum* valde distat et potius *Naucoriis* affinis videtur. Etiam haud exclusum est hunc fungum solum specimen monstrosum quaedam speciei esse, quae re normali stipitem centralem habere solet.

Crepidotus Pilati Velenovský, *Mykologia*, **6**, 66 (1929).

Typus in herbario Musei Nationalis Praegae, No. 148.385: Bohemia, Klokočná prope Strančice, 6. iv. 1924, leg. J. Velenovský.

Est *Pleurotus applicatus* (Batsch ex Fr.)—fungo parasitico infectus!

Crepidotus Pogonatus (Kalchbr.) Sacc. *Syll. Fung.* **5**, 884 (1887); *Agaricus* (*Crepidotus*) *pogonatus* Kalchbr. in *Grevillea*, **9**, 131 (1881).

Typus in herbario Kewensi ex herbario M. C. Cooke, Promont. Bonae Spei (Africa australis) ad ramulos humi iacentes mont. Boschberg, leg. MacOwan (No. 1075). Cotypus in herbario Berlin-Dahlem. (Tab. II, fig. 32.)

Pileus 0.5–1 cm. latus, habitu sat *Crepidoto variabili* (Pers. ex Fr.) Quél. similis, sed lamellis obscurius sordide argillaceo-fuscis distans, orbiculari-

reniformis, fere uno puncto substrato adnatus et ad mycelium superficiale albedo-lutescens, membranaceum insidens. Sporae globosae, haud raro paulisper 'angulatae', apiculo paulisper piriformiter contracto munitae, punctato-verrucosae, sat pallide fuscae, $5-5.6\mu$ diam.

Specimen indeterminatum ex herbario Kewensi: Town Bush, Pieter Maritzburg, Natal, S. Africa, coll. W. G. Rump (285*b*), xi. 1934. Optime cum hac specie concordat. Pileus orbicularis vel reniformis, uno puncto lateraliter adnatus, 4-10 mm. latus, extus albedo-lutescens et pallide luteo-ochraceo-tomentosus, dorso substrato adpressus et tomento ad substratum adnatus. Hoc tomentum in mycelium superficiale, tomentoso-membranaceo-arachnoideum, lutescens dilatatur. Hyphae huius mycelii superficialis irregulariter crassae, $3.2-6\mu$. Sporae globosae, paulisper 'angulatae', apiculo paulisper piriformi instructae, conspecte obtuse verrucosae, argillaceo-ferrugineae, $5.5-6.5\mu$.

Crepidotus proteus (Kalchbr. apud Thuem.) *Agaricus* (*Crepidotus*) *proteus* Kalchbr. apud Thuem. Mycotheca universalis No. 503. Thümen in *Flora*, p. 424 (1876). *Claudopus proteus* (Kalchbr.) Sacc. *Syll. Fung.* 5, 734 (1887).

Cotypus in herbario Musei Nationalis Pragae, No. 23525. (Tab. II, fig. 33.)

Diagnosis originalis 'Differt ab *Agarico variabili* Pers. pileo minore, glabro, pallide fuscescente, non vero tomentoso albo. Cetero congruit et evolutionis modus in utroque idem. Promont. Bonae Spei'. Somerset-East, in ligno humido fabrefacto, clathrato, vitifero, hortensi. Januario 1876, leg. Prof. P. MacOwan et Tuck.'

Ex exsiccato hic fungus *Crepidoto variabili* (Pers. ex Fr.) Quél. aegre similis est, praesertim modo microscopico. Pileus orbiculari-reniformis, $0.5-1$ cm. latus, albidus vel luteo-fuscidulus, laevis, subglaber, haud lucidus, margine sublobatus. Stipes distinctus, quamquam parvus, lateralis vel excentricus, 4-5 mm. longus et $0.5-1$ mm. crassus, albus, arcuatus. Sporae ellipsoideae, fuscae tinctu purpureo-violaceo, poro germinativo conspecto munitae et apiculo basali vix visibili praeditae, laeves, $7-8 (8.5) \times 5-5.6\mu$. Basidia $25-30 \times 5.7\mu$. Species generis *Melanotus* Pat. quae cum *M. musaecola* (B. & C.) Singer verisimiliter identica est.

Crepidotus putrigenus (Berk. & Curt.) Sacc. *Syll. Fung.* 5, 883 (1887); Murrill, *North Amer. Flora*, 10, 151 (1917); *Agaricus* (*Crepidotus*) *putrigenus* B. & C. in *Ann. Mag. nat. Hist.* ser. 3, 4, 292 (1859).

Typus in herbario Kewensi: Carolina Inferior, leg. Ravenel 2566. Sex carposomata. (Tab. II, fig. 34.)

Pilei 8-10 mm. lati, certe juveniles, ad ligna valde putrida crescentes. Sporae perfecte globosae, apiculo verruciformi praeditae, verrucosopunctatae, argillaceo-fuscae, $5.6-6.5\mu$ diam.

Certe cum *Crepidoto applanato* (Pers. ex Fr.) Karst. identicus!

Crepidotus pyrrhus (Berk. & Curt. Sacc. *Syll. Fung.* 5, 879 (1887); Murrill, *North Amer. Flora*, 10, 157 (1917); *Agaricus* (*Crepidotus*) *pyrrhus* B. & C. in *J. linn. Soc., (Bot.)*, 10, 291 (1868).

Typus in herbario Kewensi: Cuba, leg. C. Wright, ex herbario Berkeley. (Tab. II, fig. 35.)

Pileus 5–10 mm. latus, cum stipite brevi conspecte excentrico. Pileus subellipsoideo-flabelliformis, ad punctum insertionis stipitis angustatus, superficie subglaber, tenuiter membranaceo-carnosus. Lamellae ferrugineo-fuscae. Stipes excentricus fuscus, arcuatus, 3–5 mm. longus et 1 mm. crassus. Sporae sat obscure ferrugineae, ovato-ellipsoideae, ad apiculum conspectum fere piriformiter contractae, conspecte verrucoso-aculeatae, 8.5×5.6 – 5.8μ . Ad lignum putridum.

Specimen secundum in herbario Kewensi, quod cel. Berkeley ut *Ag. (Crepidotus) pyrrhus* B. & C. var. (Cuba, leg. Wright) designavit, modo microscopico cum primo optime concordat.

Specimen tertium ex herbario Kewensi: Botanic Garden Dominica, B. W. I. Coll. E. M. W. no 52, 20. xi. 1920 carposomata amplectit, quae quoque cum ambis speciminibus antecedentibus modo microscopico bene concordant. Nonnulla eorum stipites albedo-lutescentes, alii absque stipite sunt et pileos semiorbiculares, modo caespitoso crescentes habent. Pileus rubro-fuscus. Modo macroscopico haec specimina ab antiquis Wrightianis sat discrepant, sed modo microscopico bene concordant et ideo non dubito quin identica sint.

Singer in ephemeride, *Mycologia*, **36**, 367 (1944), et in ephemeride, *Lilloa*, **13**, 85 (1947), pro hac speciem genus novum *Pyrrhoglossum* Singer creavit. Identica species, teste Singer, *Crepidotus laceratus* Pat. est.

Crepidotus Ralfsii (Berk. & Br.) Sacc. *Syll. Fung.* **5**, 881 (1887); Cooke, *Hdb.* p. 191; *Illustr. Brit. Fungi*, t. 516 B; Massee, *Brit. Fung. Flora*, **2**, 120 (1893); Rea, *Brit. Basid.* p. 456 (1922); *Agaricus (Crepidotus) Ralfsii* B. & Br. in *Ann. Mag. nat. Hist.* ser. 5, **12**, no. 2008 (1883).

Typus in herbario Kewensi: Penzance.

Typus speciei solum carposoma juvenile *Crepidoti mollis* (Schaeff. ex Fr.) Quél. est! Stratum gelatinosum distincte inveni et summa superficie floccas ferrugineas. Sporae laeves, ellipsoideae, 8.5 – $9.3 \times 5.7 \mu$.

Crepidotus reversus (Berk. & Br.) Sacc. *Syll. Fung.* **5**, 885 (1887); *Agaricus (Crepidotus) reversus* B. & Br. in *J. linn. Soc. (Bot.)*, **14**, 32 (1873).

Tria collecta huius speciei in herbario Kewensi inveniuntur:

1. Ceylon G.H.K.T. No. 394. (Tab. II, fig. 36.)

Carposomata minuta ad fragmentum ligni putridum. Pileus 1–3 mm. latus, exsiccatu olivaceo-ferrugineo-fuscus, forma et magnitudine *Pleurotum applicatum* Batsch in mentem revocans. Sporae ferrugineae, sat obscure coloratae, globosae, maxima ex parte in apiculum piriformiter contractae, plerumque paulisper 'angulatae', conspecte obtuse et dense verrucosae, 5.5 – 6.5μ diam. Probabiliter carposomata juvenilia.

2. Peradeniya, Ceylon, 5. vii. 1919 leg. Petch, 6301.

Pileus 3–6 mm. latus, orbiculari-reniformis, uno puncto laterali insidens, basi mycelio tomentoso, luteo-ochraceo ornatus, argillaceo-fuscus tinctu olivaceo. Sporae obscure ferrugineae, globosae, in apiculum piriformem contractae, conspecte et obtuse, dense verrucosae, 5.7 – 6.5μ diam.

3. Peradeniya, Ceylon, 4. ix. 1916, leg. Petch 4875.

Pilei 5–10 mm. lati, olivaceo-ferrugineo-fusci, orbiculari-reniformes, absque stipite uni puncto laterali insidentes. Lamellae concolores. Sporae ferrugineo-fuscae, globosae, apiculo piriformi instructae, conspecte dense et obtuse verrucosae, $5.7\text{--}7\mu$.

Tria collecta commemorata unam speciem representant.

Crepidotus Ridleyi Mass. in *Kew Bull.* p. 169 (1899).

Typus in herbario Kewensi: Selangor (Malaya) on dead fern rachis, Ridley 110. Solum unum carposoma visum! (Tab. II, fig. 37.)

Pileus orbiculari-reniformis, tenuiter carnosus, 5 mm. latus, stipite laterali, fere punctiformi destitutus, superficie albus, glaber, haud lucidus, exsiccatus pallide luteolus. Lamellae fuscae tinctu purpureo-violaceo. Sporae ellipsoideae, laeves, poro germinativo distincto praeditae, fuscae tinctu purpureo-violaceo, $8\text{--}8.5 \times 4\text{--}5\mu$. Est *Melanotus musaecola* (B. & C.) Singer!

Crepidotus Rubi (Berk.) Sacc. *Syll. Fung.* 5, 881 (1887); *Agaricus* (*Crepidotus*) *Rubi* Berk. *Outl.* p. 164, t. 9, f. 7; Fries, *Hymen. Europ.* p. 276 (1974); Cooke, *Ill.* t. 515 B.

Tria collecta in herbario Kewensi inveniuntur.

1. Margate, England. 2. Killin. 3. Linlithgowshire.

Collecta commemorata omnia eadem speciem representant. Sporae late ellipsoideo-phaseoliformes, fere absque apiculo, pallide luteo-ferrugineae, $8.4\text{--}9 \times 5.5\text{--}5.7\mu$. Etiam icon in herbario Kewensi adest (Rec. 24 Oct. 1881), qui cum collectis bene concordat. (Tab. II, fig. 38.)

Est *Crepidotus haustellaris* (Fr.) Karst!

Crepidotus rufo-lateritius Bresadola in *Hedwigia*, 24, 186 (1885); Sacc. *Syll. Fung.* 5, 880 (1887); Murrill, *North Amer. Flora*, 10, 154 (1917).

Rabenhorst-Pazschke Fungi europaei etc. No. 3941. Ad corticem *Crataegi Crus-Galli*, America borealis, Emma, Missouri, leg. C. H. Demetrio, iv. 1892.

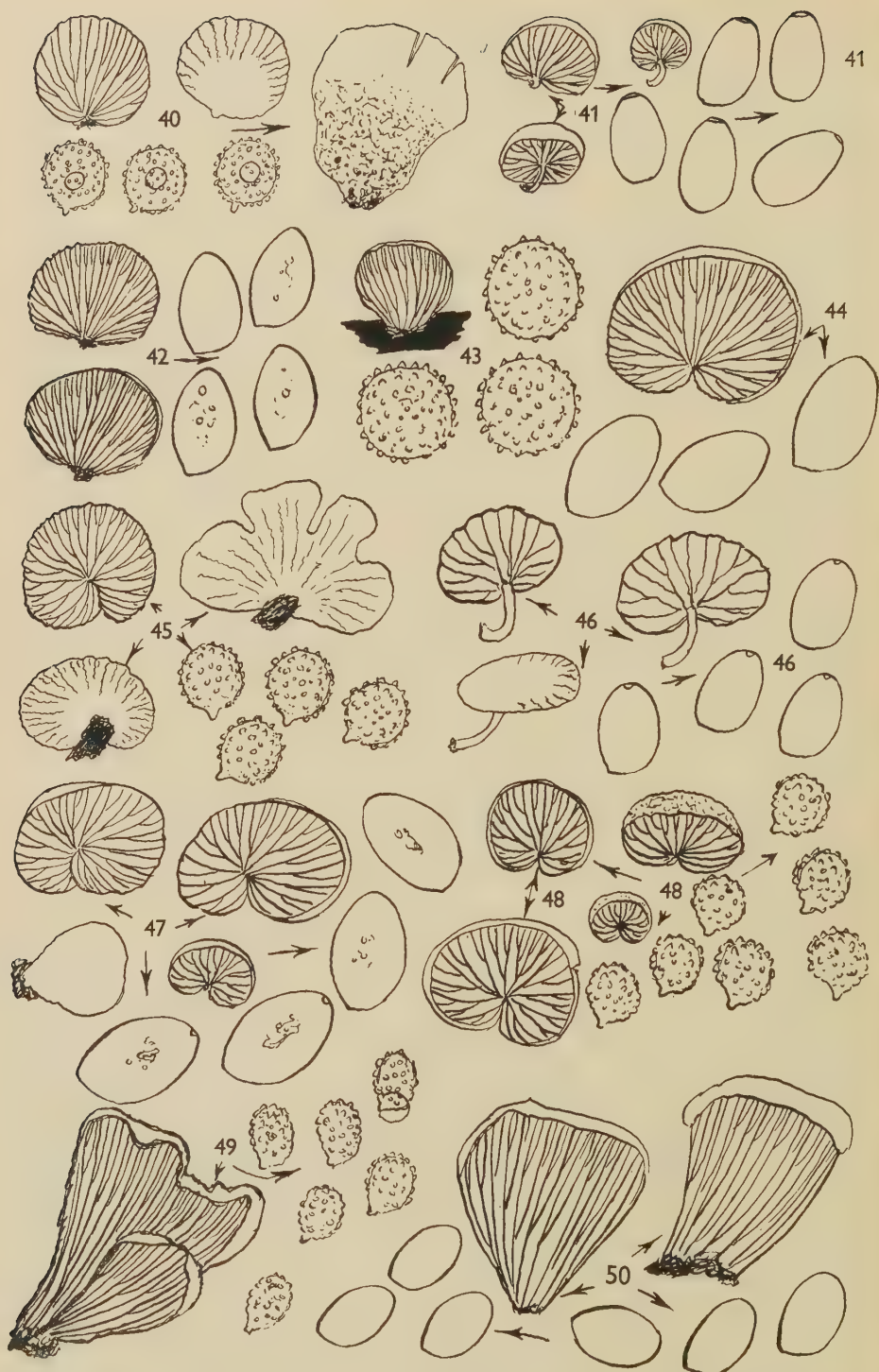
Typus ex herbario Bresadola in herbario Musei Stockholm.

Pileus 3–6 mm. latus, lateraliter adnatus et convexus, superficie obscure ferrugineo-fuscus usque obscure fuscus, haud lucidus (ut exempli gratia *Ischnoderma resinosum*) margine radialiter sulcatus. Lamellae subdistantes. Superficies pilei adpresse fusco-ferrugineo-pilosa. Pili ex hyphis jacentibus, sparsis, ferrugineo-fuscis, sat crasse tunicatis, granuloso-incrustatis, $6\text{--}9\mu$ crassis. Hyphae ceterae subhyalinae, $4\text{--}7\mu$ crassae, etiam plerumque subtiliter granuloso-incrustatae. Sporae ovato-ellipsoideae, apiculo parvo instructae, argillaceo-fuscae tinctu violaceo, $10\text{--}12 \times 7\text{--}9\mu$. Est *Phaeomarasmius rufo-lateritius* (Bres.) Singer, cf. Singer in *Lilloa*, 13, 85 (1947). (Sporae teste Singer $11.5\text{--}11.7 \times 6.7\text{--}6.8\mu$) Typus ex herbario Bresadolae in herbario Naturhistoriska Riksmuseet in Stockholm invenitur, solum notam Bresadolae habet 'Amer. bor'.

Specimen huius speciei in Rabenhorst-Pazschke No. 3941 in herbario Musei Nationalis Pragae valde defectum est.

Crepidotus spathulatus Bresadola, *Iconographia Mycologica*, t. 1248/1 (1933).

Typus in herbario Naturhistoriska Riksmuseet in Stockholm ex herbario



TABULA III

A Pilát ad nat. del.

Bresadola Africa orientalis, Foresta di Fekarie Ghemb, 19. iv. 1885, leg. Dr V. Raggazzi.

Pileus membranaceus, tenuis, spathulatus, ad basin cuneato-contractus, glaber, melleo-lutescens, margine conferte striatus, 5–10 × 7–19 mm., basi albo-tomentosus. Lamellae confertae, ferrugineo-cinnamomeae, ad basin concurrentes, acie integrae. Stipes nullus. Basidia clavata, 20–25 × 6–7 μ . Sporae ovato-ellipsoideae, sub microscopo obscure argillaceae, 8–9 × 6–6.5 μ .

Crepidotus stromaticus (Cooke & Massee) Sacc. *Syll. Fung.* **9**, 116 (1891);

Agaricus (*Crepidotus*) *stromaticus* C. & M. in *Grevillea*, **15**, 94 (1887).

Typus in herbario Kewensi: Australia, Queensland, Daintree River, leg. Pentzke. (Tab. II, fig. 39.)

Habitu *Crepidoto variabili* sat similis, sed carposomatibus mycelio tomentoso-membranaceo, albido-isabellino, superficiali insidentibus. Pileus 10–15 mm. latus, orbicularis vel reniformis, absque stipite, superficie fusco-argillaceo-tomentosus. Lamellae argillaceo-fuscae. Sporae argillaceo-fuscae, globosae, ad apiculum paulisper piriformiter contractae, saepe 'subangulatae', distincte dense obtuse verrucosae, 8–8.5 × 6.7–7.5 μ .

Cum *C. pogonato* (Kalchbr.) Sacc. identicus est.

Crepidotus terrestris Velenovský, *Novitates Mycologicae Novissimae*, p. 75 (1947).

Typus in herbario Musei Nationalis Praegae, No. 147.319: Bohemia, Mnichovice, 'Bílá skála' prope Božkov, 4. viii. 1940, leg. Velenovský.

Est *Clitopilus prunulus* (Scop. ex Fr.) Quél.

Crepidotus truncatus Petch in *Ann. R. bot. Gdns, Peradeniya*, **9**, 226 (1924).

Typus in herbario Kewensi: Ceylon, Peradeniya, 19. xii. 1914, leg. Petch, 4354. Solum dimidium unius carposomatis visum! (Tab. III, fig. 40.)

Pileus orbicularis, subflabelliformis, 17 mm. latus, uno puncto laterali adnatus, absque stipite, superficie isabellinus, exsiccatus conspecte radialiter sulcatus et verruciformiter vel granulose dense adpresse-tomentosus. Sporae perfecte globosae, apiculo parvo verruciformi munitae, subtiliter dense verrucoso-punctatae, una gutta oleacea instructae, 5.5–7 μ diam.

Species bona conspectaque. Specimen No. 4. typi *C. grumoso-pilosi* (B. & Br.) Sacc. in herbario Kewensi (cf. id.) certe cum *C. truncato* Petch identicus!

Legends to Tabula III

- Fig. 40. *Crepidotus truncatus* Petch. Magn. nat. sporae 1500 ×.
 Fig. 41. *C. turbidulus* (Berk.) Sacc. Magn. nat. sporae 1500 ×.
 Fig. 42. *C. uber* (B. & C.) Sacc. Magn. nat., sporae 1500 ×.
 Fig. 43. *C. velutinus* Petch. Magn. nat., sporae 1500 ×.
 Fig. 44. *C. austro-africanus* Pilát. Magn. nat., sporae 1500 ×.
 Fig. 45. *C. epicrocinus* (B. & Br.) Sacc. Magn. nat., sporae 1500 ×.
 Fig. 46. *C. gayi* Pilát, 3 ×, sporae 1500 ×.
 Fig. 47. *C. novae zealandiae* Pilát, Magn. nat. sporae 1500 ×.
 Fig. 48. *C. pouceensis* Pilát, 2.5 ×, sporae 1500 ×.
 Fig. 49. *C. sarawakensis* Pilát, Magn. nat., sporae 1500 ×.
 Fig. 50. *C. subaffinis* Pilát, 1.5 ×, sporae 1500 ×.

Crepidotus turbidulus Berk. in Herb. Sacc. Syll. Fung. 5, 889 (1887); and 9, 117 (1891); Cooke, Austr. Fungi, p. 60 (1892).

Typus in herbario Kewensi: Tasmania. Quatuor carposomata. (Tab. III, fig. 41.)

Pileus 5–10 mm. latus, orbicularis vel reniformis, ferrugineo-fuscus vel potius ferrugineo-tabacinus, cum stipite valde excentrico vel laterali, 1–2 mm. longo, tenui, fusco, dein plerumque fere abortivo. Pileus superficie floccoso-conspersus vel tenuiter granuloso-tomentosus. Sporae ellipsoideae, laeves, pallide ferrugineo-fuscae, poro germinativo distincto munitae, apiculo fere indistincto, $7.5-8.3 \times 5.6 \mu$. Lamellae in solutione KOH in praeparato microscopico subrubeolae.

Crepidotus uber (Berk. & Curt.) Sacc. Syll. Fung. 5, 878 (1887); *Agaricus* (*Crepidotus*) *uber* B. & C. in Proc. Amer. Acad. Arts Sci. 4, 117 (1868).

Typus in herbario Kewensi, C. Wright Coll. Herbarium of the U.S. North Pacific Exploring Expedition under Commanders Ringgold and Rodgers 1853–56, No. 46. Recd. 4/70. (Tab. III, fig. 42.)

Pileus 1.5 cm. latus flabelliformis vel orbiculato-reniformis, uno puncto laterali insidens, tenuiter membranaceo-carnosus, superficie glaber, margine haud involutus. Lamellae mediocriter confertae et latae, argillaceo-fuscae usque ferrugineae. Sporae late ovato-ellipsoideae, paulisper amygdaliformi-subfusoidae, laeves, argillaceo-fuscae, $7-8.5 \times 6.5-7 \mu$. Insulae Bonin, leg. C. Wright 1853–6. Ad hanc speciem probabiliter etiam duo collecta ex Australia in herbario Kewensi sub nomine *Crepidoti mollis* Schaeff. asservata pertinent.

1. Melbourne, ad corticem *Eucalypti*, leg. F. Reader, Herb. Kew, 9. v. 84.
2. Australia, Swan River, no. 129.

C. uber (B. & C.) Sacc. habitu et sporis *C. molli* (Schaeff. ex Fr.) Quél. valde similis est, sed stratum gelatinosum in pilei superficie non habet. Haec species praecipue in hemisphaera meridionali late distributa est.

Crepidotus variabilis (Pers. ex Fr.) Quél., var. *agrostideus* Velenovský, in herbario. Typus in herbario Musei Nationalis Pragae, No. 147.343: Bohemia, Mnichovice, in colle 'Plecháč', in caverna vulpis, ad gramina putrida viii. 1930, leg. J. Velenovský.

Est *Pleurotus septicus* (Fr.) Quél.

Crepidotus variabilis (Pers. ex Fr.) Quél. var. *graminiphilus* Velenovský in herbario.

Typus in herbario Musei Nationalis Pragae, No. 147.344: Bohemia, Zbraslav, ad gramina, 15. i. 1938, leg. V. Vacek.

Est *Pleurotus septicus* (Fr.) Quél.

Crepidotus velutinus Petch, in Ann. R. bot. Gdns, Peradeniya, 9, 225 (1924).

Typus in herbario Kewensi: Ceylon, Peradeniya, 20. xi. 1914. Solum unum carposoma visum! (Tab. III, fig. 43.)

Pileus suborbicularis, c. 1 cm. latus, absque stipite lateraliter substrato adnatus, fuscus, subtiliter piloso-tomentosus. Sporae perfecte globosae, absque apiculo, conspecte obtuse, dense verrucosae, sat obscure ferrugineo-fuscae, $8.5-9.5 \mu$ diam.

Crepidotus versutus (Peck) Sacc. *Syll. Fung.* **5**, 888 (1887); Murrill. *North Amer. Flora*, **10**, 150 (1917). Cf. R. Singer in *Lilloa*, **13**, 81 (1947); *Agaricus* (*Crepidotus*) *versutus* Peck in *Ann. Rep. N.Y. St. Mus.* **30**, 70 (1878).

Typum non examinavi, sed specimen, quod mihi amicus R. Singer misit: U.S.A. McLean, N.Y., 27. x. 1935, on back of fallen maple branch, coll. et det. A. P. Viegas, comm. W. L. White (2232), conf. R. Singer.

Est *Crepidotus terricola* Britz. sensu Favre.

Claudopus byssisedoides P. Henn. in *Hedwigia*, **43**, 183 (1904).

Cotypus in herbario Stockholm ex herbario Sydow: Brasilia, Rio Juruá, Juruá Miry, ad stipitem folii *Palmae* sp. leg. E. Ule, ix. 1901, No. 2724. Pileus 5–10 mm. latus, orbicularis, stipite brevi, laterali praeditus, haud raro fere uno puncto laterali substrato insides, pallide ochraceus, subglaber vel subtilissime tomentosopuberulus, laevis. Lamellae pallide ochraceae, cum pileo concolores, acie undulatae. Consistentia carposomatis sat coriacea. Hyphae crasse tunicatae. Sporas haud inveni. Certe species generis *Claudopus* non est—potius *Pleurotus* e sectione *Lentinopanus*.

SPECIES NOVAE

***Crepidotus austro-africanus* Pilát sp.nov.**

Pileo 2 cm. diam., rotundato-reniformi, tenuiter membranaceo-carnoso, uno puncto laterali substrato adnato (lobis duobus punctum insertionis amplectantibus), superficie in fungo exsiccato subfusco, subtiliter velutino usque subglabro, margine in speciminibus adultis haud involuto, strato gelatinoso absenti. Lamellis argillaceo-cinnamomeis (in fungo adulto exsiccato), sublatae et confertae, in punctum pilei insertionis attenuato-decurrentibus. Sporis late ovoideis, laevibus, fusco-ferrugineis, plasma homogenea vel una gutta oleosa praeditis, $8.5-11 \times 6-7 \mu$.

Hab. Africa australis, Promont. Bonae Spei, McOwan legit. Fungus in herbario Horti Botanici Regis, Kew (Britanniae) sub nomine *C. applanati* (No. 1202) asservatur. Solum unum specimen dorso ad chartam agglutinatum adest. Species ex affinitate *C. uberi* B. & C. Etiam *C. Lundellii* Pilát comparandus.

***Crepidotus subepicrocinus* Pilát sp.nov. (*C. epicrocinus* B. & Br. var.)**

Typus in herbario Kewensi: Peradeniya, Ceylon, Thwaites, No. 954*b*.

Pileus 10–25 mm. latus, reniformis, uno puncto laterali substrato adnatus, superficie sublaber, argillaceo-fuscus tinctu lateritio-rubello. Lamellae argillaceo-fuscae. Sporae perfecte globosae, apiculo parvo verruciformi instructae, subtilissime et dense obtuse verrucosae, pallide rubeolo-luteo-ferrugineae, $8.3-9$ (9.8) μ diam. Peradeniya, Ceylon, Thwaites, No. 954*b*.

A *C. epicrocino* (B. & Br.) Sacc., cui affinis videtur, sporis majoribus et subtiliter verrucosis discrepat. Berkeley et Broome nostram speciem pro varietatem *C. epicrocini* tenent. Cf. etiam *C. epicrocinus* (B. & Br.) Sacc.

***Crepidotus Gayi* Pilát sp.nov.**

Typus in herbario Parisiensi: Chile, Valdivia, ad ramulos arboris frondosae, leg. M. Cl. Gay 1839 (sub *C. variabili* (Pers. ex Fr.) Quél.)

Habitu *C. haustellarem* (Fr.) Karst. in mentem revocat. Pileus 4–6 mm. latus, valde excentricus usque sublateralis, fuscus, superficie glaber vel subglaber (paulisper pruinosus), in specimine exsiccato radialiter sulcatus. Lamellae fuscae, adnatae, nonnullae breviores, sat latae. Stipes cylindraceus, arcuatus, 2–3 mm. longus et c. 0·5 mm. latus, fuscus, subglaber vel solum paulisper pruinosus. Sporae globoso-ovoidae, laeves, ochraceae, poro germinativo parum distincto instructae et apiculo vix visibili, $7-8\cdot5 \times 5\cdot5-6\mu$. Hyphae tramae pilei subhyalinae, subcrassius tunicatae, $4\cdot5-6\mu$ crassae, nonnullae earum superficie pilei modo clavato finientibus et ibi usque 9μ crassae.

Hab. Chile, Valdivia, ad ramulos arboris frondosae, leg. M. Cl. Gay, 1839. Typus in herbario Parisiensi sub *C. variabili* (Pers. ex Fr.) Quél.

Crepidotus novae-zealandiae Pilát sp.nov. (Tab. III, fig. 47.)

Pileus absque stipite lateraliter insidens vel stipite exiguo instructus, 10–30 mm. orbiculari-reniformis, lobis duobus punctum insertionis amplexantibus, dein paulisper effuso-reflexus vel latere angustato insidens, *C. mollem* Schaeff. habitu in mentem revocans, sed probabiliter absque strato gelatinoso, superficie glaber, in speciminibus exsiccatis subtiliter irregulariter (exsiccatione) sulcatus. Lamellae ferrugineo-fuscae, forma, magnitudine et colore ut in *C. molli*. Sporae late ellipsoideae, quam in *C. molli* latiores, $11-12 \times 8\cdot3-8\cdot6\mu$, luteo-ferrugineae, poro germinativo vix visibili instructae, sat crasse tunicatae, paulisper obscurius, quam in *C. molli* Schaeff. europaeo, coloratae.

Hab. Nova Zeelandia, leg. Rev. W. Colenso, xii. 1885. Typus in herbario Kewensi sub *C. alveolo* (Lasch) Karst. (under *Fagus* log, No. 387). *C. ubero* B. & C. probabiliter proximus, a quo differt sporis paulisper aberrantibus.

Crepidotus pouceensis Pilát sp.nov. (Tab. III, fig. 48.)

Pileo 4–8 mm. lato, juventute stipite exiguo, vix distincto, destitutus, mox solum uno puncto lateraliter substrato adnatus, orbiculatus vel reniformis, lobis duobus punctum insertionis amplexantibus, dorso substrato adpressus vel subeffusoreflexus-conchiformis, argillaceo-fuscus, superficie tomentoso-puberulus, sat obscure (in statu exsiccato) coloratus, margine anguste involutus, habitu (non colore) *Pleurotum applicatum* Batsch. in mentem revocans, tenuiter membranaceo-carnosus. Lamellae confertae et angustae, obscure argillaceo-fuscae, acie pallidiores usque albiae, in punctum pilei insertionis concurrentibus. Sporae globosae vel paulisper globoso-pyriformes, apiculo distincto munitae, conspecte verrucosae, saepe paulisper 'angulatae', argillaceo-fuscae, $5-5\cdot5\mu$ diam. Hab. Insula Mauritius, Mt Pouce, ad corticem arboris frondosae, vii. 1862, leg.?. Typus in herbario Kewensi sub *Agarico applicato* Batsch.

Species *Crepidoto reverso* (B. & Br.) Sacc. et *C. pogonato* (Kalchbr.) Sacc. affinis. Demum materialia nova fines trium specierum commemoratorum iuste delimitare possint.

Crepidotus sarawakensis Pilát sp.nov. (Tab. III, fig. 49.)

Carpomatibus subimbricato-caespitosis, juventute paulisper effuso-reflexis, dein basi angustata lateraliter adnatis. Pileus 3–4 cm. latus,

cuneato-flabelliformis, margine lobatus, superficie glaber et laevis, exsiccatus fuscus (vividus probabiliter pallidior), conspecte tenuis. Lamellae conspecte confertae et longae, relativiter angustae, solum nonnullae breviores, 0.5–1 mm. latae, in fungo exsiccato obscure ferrugineo-fuscae. Trama conspecte tenuis, exsiccata valde fragilis. Sporae conspecte parvae et verrucosae, obscure fuscae tinctu purpureo-violaceo, globoso-piriformes, apiculo magno instructae, valde verrucosae, poro germinativo absenti.

Hab. Insula Borneo: Sarawak, leg. Beccari. Typus in herbario Kewensi ex herbario Cooke sub *C. molli* (det. Cesati).

Colore sporarum genus *Melanotus* Pat. in mentem revocat, sed forma sporarum, praecipue autem verrucositate ad *Crepidotos* vergit. Species maxime conspecta!

***Crepidotus subaffinis* Pilát sp.nov.** (Tab. III, fig. 50.)

C. molli habitu valde similis. Pro dolor specimen in herbario Kewensi male conservatum est. Pileus 1.5–2 cm. latus, probabiliter strato gelatinoso praeditus. Sporae parviores, quam in *C. molli* Schaeffer, ovoideo-subamygdaliformes, pallide argillaceo-ferrugineae, laeves, absque poro germinativo, $7 \times 5.5 \mu$. Ex adnotatione collectoris: 'fungus vividus superficie et lamellis albidus'.

Hab. Ad truncum vividum loco praerupto, umbroso (c. 120 m. supra mare), insula Mauritius, Chamarel, 21. i. 1890 leg. Henry Halcro Johnson. Typus in herbario Kewensi sub *Agarico alveolo* Lasch.

AD SPECIES GENERIS *CREPIDOTUS* FR. CLAVIS DICHOTOMICA

(quorum specimina originalia (typos) modo microscopico examinavi, nonnullis analysibus microscopicis, quas Singer in tractatu suo 'Contributions toward a Monograph of the genus *Crepidotus*', *Lilloa*, **13**, 59-95 (1947), publicavit, adhibitis.)

- 1a Lamellae maturae obscure fuscae tinctu violaceo-purpureo. Sporae quoque ferrugineae tinctu purpureo-violaceo coloratae, membrana laevi praeditae, ellipsoideae et poro germinativo conspecto instructae. Carposomata stipite parvo, arcuato, demum abortivo instructa, qua de causa fere puncto uno ad substratum insidentia. **Melanotus Pat. 2**
- 1b Lamellae maturae argillaceae, ferrugineae vel fuscae. Sporae laeves vel verrucosae, plerumque poro germinativo absenti, rarius poro germinativo parum evolutu instructae. **Crepidotus Fr. 3**
- 2a Carposomata sat magna, 2-4 cm. diam., margine lobato-sinuosa. Probabiliter solum exemplaria adulta et magna *Crepidoti* (*Melanoti*) musaecolae B. & C. Ceylon. **Melanotus phaeophyllus** (Berk.) Pilát comb.nov.
- 2b Carposomata minora, plerumque margine rotundata vel solum undulata, non sinuosa. Sporae 6.5-8(8.5) × 4.5-5(6) μ . Species pantropica, probabiliter etiam huc illuc in regionibus subtropicis obvia. Plerumque ad caules vel folia plantarum monocotyledonarum, rarius ad ligna putrida invenitur. In litteratura mycologica plurioribus sub nominibus variis descripta est. Typos harum specierum examinavi, quae ut synonyma huc pertinent: *Crepidotus flavo-livens* (B. et C.) Sacc. (Insulae Bonin), *C. Alpiniae* (Berk.) Sacc (Brasilia), *C. insidiosus* (Berk.) Sacc. (Tasmania), *C. Ridleyi* Mass. (Selangor, Malaya), *C. proteus* (Kalchbr.) Sacc. (Africa Australis), *C. bambusinus* Pat. (Tonquin). Sed etiam nonnullae aliae species ut synonyma huc pertinent. Teste Singer probabiliter: *C. excentricus* Murr., *C. fumosifolius* Murr., *C. haematites* B. & C., *C. Psychotriae* Pat., *C. subcuneiformis* Murr., *C. variabilis* sensu Mont. (Chile) cf. Singer in *Lilloa*, **13**, 87 (1947), et in *Lloydia*, **9**, 130 (1946).

Melanotus musaecola (B. et C.) Singer.

Species cum sporis laevibus

- 3a Sporae laeves. **4**
- 3b Sporae punctatae vel verrucosae. **39**
- 3c Sporae costis longitudinalibus ornatae, qua de causa a latere visae ellipsoideae vel amygdaliformes et verticaliter visae quinque usque octo-angulatae manifestae fiunt. In casu angulorum parum evolutorum sporae laeves fide apparent. Sporae fere hyalinae vel parum ochraceo-roseolae. Sporae in cumulo subroseae. Cf. genus *Clitopilus*. Species *Crepidotis* similes. **81**
- 4a Stipes bene vel distincte evolutus et etiam in speciminibus maturis manifestus **5**
- 4b Stipes obsoletus vel haud evolutus vel solum in speciminibus juvenilibus distinctus, quamquam plerumque parvus, serius abortivus, qua de causa specimina matura absque stipite uno puncto substrato adnata vel flabelliformia et ad basin cuneiformiter angustata sunt. **11**
- 5a Species terrestris, relativiter magna, stipite 25 × 3-4 mm. magno destituta, pileo rotundato-reniformi, 30 × 25 mm. Sporae ellipsoideae, laeves, apiculo distincto haud ornatae, absque poro germinativo, 8-9.5 × 5.5-6 μ . Australia. Potius *Naucoria* quam *Crepidotus*. **Crepidotus phaeton** (Cooke & Massee) Sacc.
- 5b Fungi minores, lignicolae.
- 6a Sporae globoso-ovoideae, ochraceae, laeves, poro germinativo parum distincto instructae et apiculo basali vix manifesto ornatae, 7-8.5 × 5.5-6 μ . Habitu *Crepidoto haustellari* Fr. similis. Pileus 4-6 mm. Stipes fere lateralis, 2-3 × 0.5 mm. magnus. Chile. **Crepidotus Gayi** Pilát.
- 6b Sporae magis elongatae. **7**

- 7a Sporae poro germinativo, saepe parum manifesto, instructae. 8
- 7b Sporae absque poro germinativo. 10
- 8a Lamellae maturae fuscae tinctu purpureo-violaceo. Sporae item obscure ferrugineo-fuscae tinctu purpureo-violaceo, poro germinativo magno conspectoque instructae. Cf. *Melanotus* Pat. 1a
- 8b Lamellae adultae pallidiores, absque tinctu violaceo-purpureo. Sporae argillaceae vel ferrugineae, sine tinctu violaceo-purpureo, poro germinativo parviore instructae. 9
- 9a Sporae $5.7 \times 3.3.5 \mu$. Pileus sordide pallide fulvus, 2–8 mm. diam. Stipes brevissimus, valde arcuatus, 1.3×0.5 mm. Ad caules emortuos et ramulos putridos, praecipue ad folia graminum. Europa. (*C. scutellinus* Quél., *Pleurotus roseolus* Lange). ***Crepidotus Phillipsii*** (B. et Br.) Sacc.
- 9b Sporae $7.5-8.3 \times 5.5 \mu$, ellipsoideo-ovoideae, pallide ferrugineo-fuscae, poro germinativo parvo sed distincto instructae, apiculo indistincto praeditae. Lamellae in solutione KOH rubeolae. Habitu *C. haustellarem* in mentem revocat. Specimina exsiccata ferrugineo-fusca usque tabacina, pileo 5–10 mm. diam., orbiculari usque reniformi et stipite 1–2 mm. longo, dein evanescenti. Pileo superficie floccoso-farinoso usque tenuiter granuloso-tomentoso. Tasmania. ***Crepidotus turbidulus*** (Berk.) Sacc.
- 10a Sporae in aqua pallide luteo-ferrugineae, in solutione KOH obscurius rubro-ferrugineae (ut in *C. hiberniano* Pearson). Pileus 10 mm. diam., stipes 1.5 mm. longus, exiguus. Lamellae luteo-ferrugineae. Lamellae in KOH colorem luteum emittent. Sporae $8.5-9 \times 5.8-6.4 \mu$, late ellipsoideo-phascoliformes, fere sine apiculo. Ceylon. (Cf. etiam *C. hibernianus* Pearson) ***Crepidotus flavo-marginatus*** (B. et Br.) Sacc.
- 10b Sporae in KOH haud obscurius colorantur. Carposomata argillaceo-fusca, stipite distincto griseo-fusco vel fusco instructa. Nonnullas species generis *Naucoria* habitu in mentem revocat et certe huic generi affinis est. Sporae late ellipsoideo-phaseoliformes, apiculo vix conspicuo munitae, $8-9 \times 5.5-6.5 \mu$. Europa, Australia etc. ***Crepidotus haustellaris*** (Fr.) Karst.
- 11a Sporae globosae vel subglobosae. 12
- 11b Sporae magis elongatae, ellipsoideae etc. 13
- 12a Sporae $5.6.7 \times 4.8-6 \mu$. Pileus 5–7.5 mm., glaber, albidus. Lamellae pallidae usque luteo-fuscae. America bor.: Michigan. ***Crepidotus albidus*** Ell. et Ev.
- 12b Sporae $6.5-7.3(8.3) \times 5.5-6.3(6.6) \mu$. Florida. ***Crepidotus amarus*** Murr.
- 13a Cutis pilei crassa, gelatinosa vel tota trama pilei gelatinosa. 14
- 13b Cutis pilei gelatinosa haud evoluta est etiamque trama pilei haud gelatinosa. 17
- 14a Pileus squamulosus usque squamuloso-aculeatus. 15
- 14b Pileus laevis. 16
- 15a Pars pilei dorsalis squamulis erectis aculeiformibus obsita. Pileus 3 cm. diam., mellinus, centro tinctu ochraceo ornatus. Lamellae cremeae, dein fulvae. Sporae $8.8-11 \times 6-7 \mu$, ellipsoideae, laeves. Jamaica. ***Crepidotus calolepioides*** Murr.
- 15b Pileus adultus pallide subluteo-ochraceus, obscurius adpresse squamulosus, 3–5(8) cm. latus. Sporae $7-9.5 \times 5-6.5 \mu$. Europa, Asia borealis, America borealis, Australia. ***Crepidotus mollis*** var. ***calolepis*** (Fr.) Pilát.
- 16a Tota trama pilei gelatinosa. Specimina juvenilia pileo albo—etiam in statu exsiccato. Sporae melleo-fusculae, $6.8-8.2 \times 4.4-8 \mu$ (teste Singer). Pileus 2 cm. latus. Lamellae juventute albae, dein sporis pulverulentae et coloratae. America bor. New York, ad ligna *Betulae lentae*. ***Crepidotus Betulae*** Murr.
- 16b Tota trama pilei debiliter gelatinosa (cf. etiam *C. uber* B. & C. 37b). Pileus non stipitatus usque resupinatus, 2 cm. diam., aquose albidus, puberulus

usque glabratus. Lamellae albae, dein subfulvae. Sporae $8.2-10.5 \times 5.2-6.8 \mu$, ellipsoideae, fuscido-mellinae. (*C. cinchonensis* Murr., *Tremellopsis antillarum* Pat. ap. Duss.) America tropica.

Crepidotus antillarum (Pat. ap. Duss) Singer.

- 16c Stratum superficiale pilei gelatinosum, trama cetera gossipino-carnosa. Pileus maturus lutescenti-ochraceus, 2-8 cm. latus. Europa etc.

Crepidotus mollis (Schaeff. ex Fr.) Quél.

- 16d Habitu *Crepidotum mollem* Schaeff. in mentem revocat. Stratum pilei superficiale probabiliter quoque gelatinosum. Sporae paulisper minores, ovoideae, subcitriformes, pallide argillaceo-ferrugineae. Fungus vivus albus. Pileus 1.5-2 cm. latus. Mauritius.

Crepidotus subaffinis Pilát.

- 17a Pileus parvus, plerumque minor quam 2 cm. diam.

18

- 17b Pileus plerumque major quam 2 cm. diam.

34

- 18a Sporae breviter ellipsoideae usque fere globosae, $7.5-8.5 \times 5.5-6.8 \mu$. Pileus 0.5-1 cm. latus, forma *C. variabili* similis. Lamellae argillaceo-obscure ferrugineae. Guadeloupe. Cf. etiam *C. pecten* B. & C.

Crepidotus Citri Pat.

- 18b Sporae magis ellipsoideae.

19

- 18c Sporae elongato-ellipsoideae usque fere cylindraceo-fusiformes, basin versus conspecte oblique acutatae, $7-9 \times 2.3-3 \mu$, subhyalinae vel solum debiliter lutescentes. Lamellae primum albae, exsiccatae luteo-fuscae. Pileus parvus, membranaceus, conchiformis, albus, 5-10 mm. latus. (*Pleurotus chioneus* sensu Quélet, Favre, Bresadola, non Schroeter nec Pilát)

Pleurotus septicus (Fr.) Quél. sensu Schroeter et Pilát.

- 18d Sporae late ovoideae, $7.5-9.5 \times 4.5-6 \mu$, costis longitudinalibus plerumque octo ornatae, subhyalinae, in cumulo subroseo-ferruginascentes. Pileus albus, parvus, 3-20 mm. diam. (*Clitopilus pleurotelloides* Kühner.)

Clitopilus chioneus (Pers.) Pilát

- 19a Pileus spathulatus, membranaceus, tenuis basin versus cuneiformiter contractus, glaber, melleo-lutescens, margine conferte striatus, $5-10 \times 7-19$ mm., basi albotomentosus. Lamellae ferrugineo-cinnamomeae. Sporae ellipsoideae, $8-9 \times 5-6.5 \mu$, sub microscopo obscure argillaceae. Africa.

Crepidotus spathulatus Bres.

- 19b Pileus haud spathulatus.

20

- 20a Superficies pilei adpresse fusco-ferrugineo-pilosa. Pili epicutis materia resinacea ferrugineo-fusca incrustati. Pileus 3-6 mm. latus, exsiccatus obscure ferrugineo-fuscus usque obscure fuscus, haud lucidus (fere ut *Ischnoderma resinosum*), margine radialiter e lamellis rimosus. Sporae apiculo parvo instructae, ovoideo-ellipsoideae, $10-12 \times 7-9 \mu$. America borealis.

Phaeomarasmius rufolateritius (Bres.) Singer

- 20b Fungi alii.

21

- 21a Fungus minimus, pileo solum 1.6-2.5 mm. lato, conchiformi usque subcupuliformi, extus albo-piloso, lamellis pallide ochraceo-fuscis, habitu *Crepidotum Wakefieldiae* Pilát in mentem revocans. Ad ramulos parvos habitat. Sporae laeves, subpallide argillaceo-fuscae, ellipsoideae, apiculo munitae, plerumque paulisper subamygdaliformes vel irregulares angulato-compressae et contractae, forma sat variabiles, $8.5-9 \times 5.7-6 \mu$. Ceylon

Crepidotus pezizula (B. & Br.) Sacc.

- 21b Fungi paulisper majores, characteribus aliis praeditae.

22

- 22a Sporae elongato-ellipsoideae.

23

- 22b Sporae ellipsoideae vel late ellipsoideae vel amygdaliformes.

25

- 23a Sporae perfecte laeves.

24

- 23b Sporae minime subtiliter punctatae. Plerumque ad caules plantarum majorum, rarius ad ligna emortua. Europa. (*C. versutus* Peck, *C. luteolus* Lambotte.)

Crepidotus terricola Britz. sensu Favre.

- 24a Sporae elongato-ellipsoideae, 8·5–12 × 5–6 μ . Pileus 1–2·5 cm. Ad terram vel ad ramulos et frustula lignea vel residua plantarum praecipue in terra paulisper sepultarum. Europa. (*C. pubescens* Bres.) **Crepidotus Bresadolae** Pilát.
- 24b Sporae fusideo-cylindraceae ut in Boletis, 14–15 × 5·6–6 μ . Pileus haud stipitatus, 4·5 × 3 cm. **Crepidotus pactolus** Cooke.
- 25a Pileus cinnabarinus vel fere carmineo-ruber. Acies lamellarum carmineo-rubra. Lamellae juveniles albiae, tum ochraceo-ferrugineae. Sporae globoso-ovoideae usque fere piriformes, subillime et indistincte punctatae. Europa, America borealis. **Crepidotus cinnabarinus** Peck.
- 25b Pileus aliter coloratus. 26
- 26a Sporae breviter ellipsoideae usque fere globoso-ellipsoideae 27
- 26b Sporae ellipsoideae. 28
- 27a Sporae 9–9·3 × 6·5–7 μ , argillaceo fuscae, apiculo parvo munitae. Pileus 3–10 mm., orbicularis, dorso substrato adnatus, extus floccoso-tomentosus, fuscus. Lamellae argillaceo-fuscae tinctu olivaceo, subobscurae et triste coloratae. *Crepidoto Lundellii* Pilát var. *subglobisporo* Pilát proxime accedit sed sporis majoribus et obscurius coloratis differt. America borealis: Carolina Australis. **Crepidotus pecten** (B. & C.) Sacc.
- 27b Sporae 6·5–7·5 × 4·5–5·5 μ . Pileus albus, exsiccatus paulisper ochraceo-luteus. Lamellae maturae argillaceo-fuscae. Europa. **Crepidotus Lundellii** Pilát var. *subglobisporus* Pilát.
- 28a Sporae in aqua luteo-fuscae, in solutione KOH obscure ferrugineae. Pileus 8–14 mm. diam., orbicularis, stipite brevissimo laterali munitus vel plerumque absque stipite uno puncto substrato adnatus, superficie ferrugineus, marginem versus sulphureo-pruinosis. Sporae ovoideo-ellipsoideae, 8–10 × 6–6·8 μ . Europa. **Crepidotus hibernianus** Pearson.
- 28b Sporae in KOH haud obscurius colorantur. 29
- 29a Sporae perfecte laeves. 30
- 29b Sporae subillime verruculoso-punctatae. Praecipue ad cortices *Robiniae pseudacaciae* in Europa habitat. **Crepidotus subverrucisporus** Pilát.
- 30a Sporae parvae, 5·6 × 3 μ , conspice pallide ochraceae, sub microscopo subhyalinae. Pileus 1·5–2 cm. latus, conchiformis, cremeus. Tasmania. **Crepidotus Auricula** (Berk.) Sacc.
- 30b Sporae majores. 31
- 31a Sporae absque poro germinativo. 32
- 31b Sporae poro germinativo praeditae. 33
- 32a Pileus 4–11 mm. diam., pallide isabellinus, probabiliter laevis, marginem versus paulisper crenulatus et striatus, sublobulatus, orbiculari-reniformis, plus minus uno puncto adnatus. Lamellae argillaceo-fuscae. Sporae ellipsoideae, ferrugineae, 9·5–10·5 × 6–6·5 μ . Ceylon. **Crepidotus grumoso-pilosus** (B. & Br.) Sacc. em. Pilát.
- 32b Pileus 3–5 mm. latus, lateraliter adnexus usque paulisper effusoreflexus, exsiccatus argillaceo-fuscus, superficie paulisper tomentosus. Lamellae argillaceo-fuscae, relativiter sat carnosae. Habitu *Crepidotus cassiaeae* Berk. in mentem revocat, sed sporis discrepat. Australia. **Crepidotus leptus** (Berk.) Sacc.
- 33a Sporae 7·5–8·5 × 5–5·6 μ , ellipsoideae, uno latere paulisper applanatae, pallide argillaceae, membrana conspice pallida et plasma obscurius colorata instructae, poro germinativo sat distincto munitae. Pileus reniformis, 8–10 mm. latus, probabiliter juventute stipite punctiformi instructus, relativiter crasse carnosus. Trama lamellarum ex hyphis paulisper gelatinosis, qua de causa sectae paulisper lucidae et quoque stratum pilei superficiale sectum paulisper lucidum, ex hyphis ferrugineis, conferte intricatis, 3–5 μ crassis. Trama cetera e hyphis pallidioribus, paulisper laxius et irregulariter intricatis, lutescentibus. Pileus relativiter compactus et crasse carnosus, minus quam species ceterae fragilis. Tasmania. **Crepidotus cassiaeae** (Berk.) Sacc.

- 33^b Sporae 6·6-7(7) × 5·3-5·6 μ , ovoideo-ellipsoideae, sat obscure argillaceae, abscissae (porus germinativus?), forma sporis generis *Melanotus* similes, sed absque tinctu purpureo-violaceo. **Crepidotus hepatochrous** (Berk.) Sacc.

- 34^a Sporae 8·5-11 × 6-7 μ , late ovatae laeves, fusco-ferrugineae. Pileus c. 20 mm. latus, rotundato-reniformis, tenuiter membranaceo-carnosus, forma *Crepidotum variabilem* in mentem revocans, subtiliter velutinus usque fere glabratus. Lamellae in fungo exsiccato argillaceo-cinnamomeae. Africa australis.

Crepidotus austro-africanus Pilát.

- 34^b Sporae 10·5-11·5 × 7·8-8·2 μ , elongato ellipsoideae, subamygdaliformes vel usque subphaseoliformes, forma sat variables, laeves, poro germinativo indistincto, apiculo vix visibili, luteo-fuscae. Pileus 30-40 × 15 mm., late semiorbicularis, uno puncto laterali insidens, conspecte crasse et sat firme carnosus, alutaceus, praecipue parte media dense obscurius setaceo-squamulosus. Lamellae luteo-cinnamomeae, sat latae. Cheilocystidia anguste lageniformia, haud raro subcapitato-clavata, forma sat variantia. Ad truncum vivum *Eucalypti obliquae*. Tasmania

Crepidotus parasiticus Mass.

- 34^c Sporae 11-12 × 8·3-8·6 μ , late ellipsoideae, poro germinativo vix conspecto munitae, sat crasse tunicatae, paulisper obscurius quam in *Crepidoto molli* coloratae. Pileus 1-3 cm. latus, absque stipite vel in juventute stipite minimo praeditus, orbicularis vel reniformis, dein pro parte effusoreflexus vel latere angustato adnexus, *Crepidoto molli* similis, sed probabiliter absque strato gelatinoso superficiali, extus glaber, exsiccatus subtiliter corrugatus. Lamellae ferrugineo-fuscae. Nova Zeelandia.

Crepidotus novae-zeelandiae Pilát.

- 34^d Sporae parviores.

35

- 35^a Sporae quam 7 μ breviores.

36

- 35^b Sporae quam 7 μ longiores.

37

- 36^a Sporae globosae, 5-5·5 μ . Trama lamellarum haud bilateralis. Europa, peninsula Balcanica.

Crepidotus serbicus Pilát.

- 36^b Sporae late ellipsoideae vel ovoideae, 5·5-6·5 × 3-4 μ . Trama lamellarum bilateralis. Lamellae crassae et remotae. Europa, etc.

Crepidotus panuoides (Fr.) Pilát.

- 37^a Species terrestres vel ad frustula plantarum majorum et ad ligna in terra sepultis provenientes.

38

- 37^b Species lignicola, *Crepidoto molli* similis, pileo 1·5-4 cm. lato, sed absque strato gelatinoso superficiali. Pileus flabelliformis vel reniformis. Lamellae argillaceo-fuscae usque ferrugineae. Sporae 7-8·5 × 6·5-7 μ , ellipsoideae, subamygdaliformes, argillaceo-fuscae. Species pantropica, *C. mollem* in regionibus calidis compensans. In regionibus tropicis et subtropicis Africae, Americae, Asiae et Australiae late distributa.

Crepidotus uber (B. & C.) Sacc.

- 38^a Sporae late ovoideae, haud amygdaliformes, 7-8·5 × 5-5·6 μ . Europa.

Crepidotus Caspari Velenovský.

- 38^b Sporae late citriformiter-ovoidae vel late amygdaliformes, quam in *C. Caspari* Vel. obscurius coloratae. Europa.

Crepidotus fragilis Jossierand.

Species cum sporis verrucosis vel punctatis

- 39^a Hyphae tramae cum pigmento crystallino laete lilacino. Pileus roseus, 4-6 mm. latus. Lamellae roseae, dein subfuscae. Sporae subglobosae, 6·5-7 × 5·3-5·8 μ . Florida.

Crepidotus roseus Singer, 1947.

- 39^b Hyphae tramae hyalinae vel alias coloratae.

40

- 40^a Stipes etiam in fungo maturo distinctus.

41

- 40^b Stipes deest vel solum in juventute manifestus.

43

- 41^a Cheilocystidia longa et sublata (49-80 × 9-13 μ). Pileus 40-50 μ latus. Stipes excentricus. Sporae fere globosae, 6·3-7·2(9·3) × 5-6·2(8) μ .

Crepidotus nyssicola Murr.

- 41b Cheilocystidia alia vel haud evoluta. 42
- 42a Sporae $5.5 \times 3.2-3.8(4) \mu$, apiculo distincto ornatae, nonnullae paulisper amygdaliformes, sat obscure ferrugineo-fuscae, valde verrucosae. Pileus $1.5-2.5$ cm. latus, fuscus. Stipes subcentralis usque valde excentricus, $1.5-2$ cm. longus et 5 mm. latus, superficie asper (probabiliter reliquum veli), fuscus. Specimina exsiccata fragillima. Lamellae ferrugineae, subconfertae. In affinitatem generis *Pholiota-Rozites* probabiliter pertinet, cum velum parziale haud manifeste evolutum sit. Ad terram arenosam. Ceylon.
- Crepidotus hepaticus** (Berk.) Sacc.
- 42b Sporae $8-8.5 \times 5.6-5.8 \mu$, fusco-ferrugineae, ovato-ellipsoideae, ad apiculum fere piriformiter contractae, valde verrucoso-aculeatae. Pileus $0.5-1$ cm. latus, stipite brevi et valde excentrico instructus, fere ellipsoideo-flabelliformis, superficie subglaber, tenuiter membranaceo-carnosus. Lamellae ferrugineo-fuscae. Stipes $3-5 \times 1$ mm. Cuba, Dominica. *Crepidotus laceratus* (Pat.) Singer (in *Mycologia*, 36, 367 (1944) hunc fungum in genus novum, autonomum, *Pyrrhoglossum* sing. dictum, inseruit.
- Crepidotus pyrrhus** (B. & C.) Sacc.
- 42c Sporae $8-9 \times 7-8 \mu$, subglobosae vel breviter ovoideae, membrana subillime verrucosa ornatae. Stipes fere semper manifeste, etiam in maturitate, evolutus. Ad muscos vivos insidet. Europa.
- Crepidotus carpatorossicus** Pilát.
- 43a Sporae perfecte globosae, solum apiculo parvo, verruciformi munitae vel absque apiculo, numquam ad apiculum piriformiter contractae. 44
- 43b Sporae globosae, ad apiculum paulisper cuneiformiter vel piriformiter contractae vel ovoideae usque ellipsoideae vel elongatae 53
- 44a Sporae $8-9.5 \mu$. 45
- 44b Sporae minores. 47
- 54a Pileus orbicularis vel reniformis, habitu *C. variabilem* in mentem revocans, $8-12$ mm. latus, dorso ad substratum adpressus, in statu vivo probabiliter citrino-luteus. Lamellae fuscae. Sporae perfecte globosae, valde denseque verrucoso-aculeatae (magis quam in *C. applanato*). Ceylon.
- Crepidotus citrinus** Petch (non Larsen).
- 45b Color pilei alius. 46
- 46a Pileus fuscus, subtiliter pilosulo-tomentosus, orbicularis, absque stipite, 1 cm. latus. Sporae perfecte globosae, absque apiculo, valde dense obtuseque verrucosae, sat obscure ferrugineo-fuscae, $8.5-9.5 \mu$ diam. Habitu et magnitudine *C. citrino* Petch valde similis. Ceylon.
- Crepidotus velutinus** Petch.
- 46b Pileus exsiccatus argillaceo-fuscus tinctu lateritio-rubro, $10-25$ mm. latus, reniformis, uno puncto laterali adnatus, superficie fere glaber. Lamellae argillaceo-fuscae. Sporae perfecte globosae, apiculo parvo verruciformi munitae, subillime et dense obtuse verrucosae, pallide rubro-luteo-ferrugineae. Ceylon.
- Crepidotus subepicrocinus** Pilát.
- 47a Sporae omnino parvae, globosae et punctatae, $4.8-5.5 \mu$. Pileus $1-4$ mm. latus, e orbiculari reniformis usque conchiformis, candidus, floccoso-puberulus, non stipitatus, uno puncto villosa substrato adnatus. America tropica. (*C. parvulus* Murr.)
- Crepidotus quitensis** Pat.
- 47b Sporae majores, $5.5-7 \mu$ diam. 48
- 48a Sporae apiculo sat magno instructae, sed alias perfecte globosae, distincte sed humiliter verrucosae, $6-7 \mu$ diam., pallide luteo-rubro-argillaceo-ferrugineae. Pileus e orbiculari reniformis, $10-30$ mm. latus, haud stipitatus, dein lobatus, laete croceo- vel aurantio-tomentosus, dein potius glabrescens et argillaceo-ochraceus. Lamellae vivae probabiliter albiae, in fungo exsiccato pallide argillaceo-fuscae, sat distantes.
- Crepidotus epicrocinus** (B. & Br.) Sacc.
- 48b Sporae cum apiculo parviore. 49

- 49a Pileus 17 mm. diam., longe radialiter striatus, dense adpresseque granuloso-tomentosus, orbicularis-flabelliformis, uno puncto laterali adnatus. Lamellae argillaceo-fuscae. Sporae perfecte globosae, apiculo verruciformi munitae, conferte subtiliter verrucoso-punctatae, una gutta oleosa praeditae, 5·5–7 μ diam. Ceylon. **Crepidotus truncatus** Petch. 50
- 49b Fungi alii, pileo plerumque majore, in regionibus temperatis distributi. 50
- 50a Sporae 6–7·5 μ diam. Habitu *C. applanato* similis. America borealis, Australia. **Crepidotus applanatus** var. **globiger** Berk. 51
- 50b Sporae 5–6·5(7) μ diam. 51
- 51a Lamellae juveniles tinctu salmonicolori vel subaurantiaco. Pileus 1–4 cm. latus. Sporae globosae, punctatae, 5·8–6 μ . Fungus boreali-americanus et europaeus, cum *C. applanato* Pers. var. *fulvifibrilloso* (Murrill) probabiliter identicus. **Crepidotus applanatus** (Pers. ex Fr.) Karst. var. **crocophyllus** (Berk.) Pilát. 52
- 51b Lamellae juveniles albae vel albidae. 52
- 52a Pileus 3–5 cm., superficie tenuiter fusco-ferrugineo-tomentosus, dein ferrugineo-tomentoso-squamulosus. Fungus probabiliter cum *C. applanato* var. *crocophyllo* Berk. identicus. Europa, America bor. **Crepidotus fulvifibrillosus** Murrill. 53
- 52b Pileus, 1·5–5 cm. latus, haud squamulosus, conspecte hygrophanus, albus vel albidus, glaber, solum ad basin paulisper tomentoso-pilosus, adultus fere non stipitatus, orbiculari-flabelliformis vel reniformis, prima juventute totus albus, subspathulatus et distincte lateraliter stipitatus, adultus uno puncto lateraliter adnatus. Sporae 5–6·5 μ , perfecte globosae, punctatae. Lamellae primum albae, dein ferrugineae. (*C. nephrodes* B. & C., *C. malachius* B. & C., *C. dorsalis* Peck, *C. stipitatus* Kauffman, *C. longistriatus* Imai, *C. putrigenus* B. & C.) Eurasia temperata, America borealis. **Crepidotus applanatus** (Pers. ex Fr.) Karst. 54
- 53a Sporae globosae, apiculo conspecto munitae et ad apiculum paulisper cuneiformiter contractae, qua de causa globoso-subpiriformes, haud raro paulisper angulatae (cf. etiam 48a et 69b) 54
- 53b Sporae globoso-ovoideae, absque apiculo conspecto vel ellipsoideae vel elongato-ellipsoideae. 64
- 54a Pileus relativiter magnus, 3–4 cm. latus. 55
- 54b Pileus minor. 56
- 55a Sporae 5·5–6·2 $\times$ 4·6–5 μ , globoso- vel ovoideo-piriformes. Pileus conchiformis, elongatus, basi angustata substrato adnatus, superficie tomentoso-pilosus, magnitudine, forma et colore *C. panuoidem* sat in mentem revocans. Europa: peninsula Balcanica. **Crepidotus macedonicus** Pilát. 57
- 55b Sporae 4·5·5 $\times$ 3·2–4 μ . Pileus superficie glaber et laevis, conspecte tenuis, lateraliter adnatus. Carposomata paulisper imbricato-caespitosa. Lamellae conspecte confertae, relativiter angustae (0·5–1 mm. latae), in fungo exsiccato obscure ferrugineo-fuscae. Sporae conspecte parvae et verrucosae, obscure fuscae tinctu purpureo-violaceo, globoso-piriformes, apiculo magno instructae. **Crepidotus sarawakensis** Pilát. 58
- 56a Pileus cinnabarinus. Acies lamellarum carmineo-rubra. Sporae 7–8·5 $\times$ 4·5–5·7 μ , globoso-piriformes, minutissime punctatae. America bor., Europa. **Crepidotus cinnabarinus** Peck. 59
- 56b Pileus aliter coloratus. 59
- 57a Sporae subhyalinae, id est membrana fere hyalina instructae et plasma minime subfusca impletae, 7–8 $\times$ 6·5–7 μ . Specimen originale miserum. Species incerta. Pileus e descriptione auctoris reniformis, ochraceo-albidus. Stipes brevissimus, lateralis. Probabiliter haud species generis *Crepidotus*. Tasmania. **Crepidotus interceptus** (Berk.) Sacc. 60
- 57b Sporae argillaceae vel ferrugineae. 60

- 58a Sporae 8-8.5 × 5.6-5.9 μ. Pileus 1-2 cm. latus, flabelliformis, versus basin paulisper cuneiformiter contractus, superficie glaber et radialiter sulcatus, membranaceo-carnosus. Sporae globoso-piriformes, apiculo distincto et depressione hilari instructae. *C. appianato* Pers. affinis, sed diversus. Insulae Bonin.

***Crepidotus leucochrysos* (B. & C.) Sacc.**

- 58b Sporae parviores. 59
- 59a Sporae 6.5-8 μ. 60
- 59b Sporae parviores. 61
- 60a Sporae 6.8-8 × 5.7-6.8 μ. Pileus 10-25 mm. latus, cinnamomeus, vivus aquose-fuscus, striatus vel sulcatus. Sporae perfecte globosae vel globosae, punctatae. (*C. aquosus* Murr.) In regionibus tropicis Americae borealis et centralis.

***Crepidotus cuneiformis* Pat.**

- 60b Sporae 6.5-8 μ diam. subglobosae, conspecte aculeatae. Pileus 5-10 mm. latus, obscure argillaceo-fuscus. Lamellae obscure argillaceae. Africa: Camerun.

***Crepidotus echinosporus* P. Henn.**

- 61a Pileus conspecte parvus, 2-4 mm. latus, non stipitatus, juventute parte dorsali parva adnatus, albidus tinctu sordide fusco. Sporae globoso-piriformes, apiculo magno munitae, argillaceo-fuscae, distincte et dense subtiliter verrucosae, 5-5.7(6) μ diam. Europa: Britannia.

***Crepidotus Wakefieldiae* Pilát.**

- 61b Pileus major. 62
- 62a Sporae 5-5.5 μ diam., globoso-piriformes, apiculo distincto munitae, conspecte verrucosae, usque fere subangulatae, argillaceo-fuscae. Pileus 4-8 mm. latus, juventute stipite parvo instructus, dein absque stipite uno puncto substratu adnatus, rotundatus vel reniformis, superficie tomentoso-puberulus, obscure argillaceo-fuscus. Lamellae confertae et angustae, obscure argillaceo-fuscae, acie albidae vel pallidiores. *C. reverso* B. & Br. et *C. eumyceliato* Kalchbr. species valde affinis. Haud exclusum est hos tres fungos solum speciem unam representare. Mauritius (cf. etiam 63b).

***Crepidotus pouceensis* Pilát.**

- 62b Sporae paulisper majores, 5.5-6.5 μ diam. 63
- 63a Carposomata plerumque laxe gregaria et ad mycelium superficiale, gossypino tomentosum, albido-lutescens insidentia. Pileus 0.5-1.5(2) cm. latus, orbicularis, uno puncto adnatus. Sporae 5.5-6 μ. Probabiliter species pantropica, praecipue in Africa australi distributa. Africa australis, Chile, Australia. (*C. eumyceliatus* Kalchbr., *C. epispaerius* (Berk.) Sacc., *C. stromaticus* (C. & M.) Sacc. *C. inandae* (Cooke) Sacc.).

***Crepidotus pogonatus* (Kalchbr.) Sacc.**

- 63b Pileus 2-10 mm. latus, obscure argillaceo-fuscus vel exsiccatus tinctu olivaceo, orbicularis vel reniformis, uno puncto modo *C. variabilis* adnatae, plerumque basi mycelio lutescenti-ochraceo gossypino instructae. Sporae 5.5-6.5(7) μ, globosae, in apiculum piriformiter contractae, saepe paulisper subangulatae. *C. pouceensi* et *C. eumyceliato* Kalchbr. peraffinis (vel identicus?). Ceylon. Tria specimina vidi.

***Crepidotus reversus* (B. & Br.) Sacc.**

- 64a Sporae globoso-ovoideae, absque apiculo conspecto. 65
- 64b Sporae ellipsoideae vel elongato-ellipsoideae. 70
- 65a Pileus minor quam 5 mm. 66
- 65b Pileus major quam 5 mm. 67
- 66a Pileus 1-2 mm. latus. Stipes fere semper etiam in fungo maturo distincte evolutus ad muscos vivos insidet. Sporae subglobosae vel breviter ovoideae, membrana subtilissime punctata instructae, 8-9 × 7-8 μ. Europa.

***Crepidotus carpatorossicus* Pilát.**

- 66b Pileus 1-3 mm. latus. Lamellae conspecte latae. Sporae 6.5-7.5 × 5-6 μ, fusciculo-mellinae.

***Crepidotus praelatifolius* Murr.**

- 67a Pileus, etiam exsiccatus, superficie albus, tomentoso-pilosus, 5–20 mm. latus. Sporae globoso-ovoideae, fere absque apiculo, distincte verruculosae, 7–10 × 6–8 μ . Ad ligna arborum frondosarum et coniferarum. Europa. (*C. sphaerosporus* Pat., *C. Eucalypti* Torr., *C. carpaticus* Pilát, *Claud. Zahlbruckneri* Beck.)
Crepidotus Cesatii Rab. 68
- 67b Pileus in fungo exsiccato plerumque haud albus, sed paulisper coloratus. 68
- 68a Pileus 10–42 mm. latus, ochraceo-alutaceus in parte dorsali paulisper obscure ochraceo-luteus, convexus usque subplanus, adnatus, superficie glaber, haud raro basi paulisper pilosus. Lamellae distantes, latae, albiae, dein obscure croceo-luteae usque ferrugineae. America. **Crepidotus croceitinctus** Peck. 69
- 68b Pileus minor. 69
- 69a Sporae 6–7.5 × 5–5.7 μ , breviter ovoideae, subtiliter sed distincte verrucosae, aculeatae, pallide argillaceo-ferrugineo-fuscae, absque guttis oleosis. Pileus 5–10 mm. latus. Ad muscos vivos insidet vel ad terram arenosam inter muscos invenitur *C. epibryus* (Fr.) Quél. similis, sed minor, sporisque minoribus. Europa. **Crepidotus subepibryus** Pilát.
- 69b Sporae 5–6.5 × 5–6 μ , globosae vel late ellipsoideae, aculeatae. Pileus 5–8 mm. latus, citrino-luteus. (*C. citrinus* Larsen, non Petch.) Iceland. **Crepidotus Larseni** Pilát.
- 70a Fungus magnus pileo 2.5–8 cm., ad ligna quercina in Carolina Septentrionali distributus. Pileus pallide fuscus, conchiformis, dense tomentosus, fuscidulo-pallidus, non stipitatus; plerumque pluriora carposomata imbricato-caespitosa. Lamellae conspecte latae, ex albido fusco-ferrugineae. *C. panuoidi* similis, sed colore lamellarum et sporis differt. Cf. Singer in *Farlowia*, 2, 544 (1946). America borealis. **Crepidotus reniformis** (Berk. & Rav. ap. B. & C.) Singer.
- 70b Pileus minor. 71
- 71a Sporae parvae, 5.5–7.2 × 2.8–3.7 μ . 72
- 71b Sporae majores. 73
- 72a Sporae 5.5–7 × 2.8–3.5 μ , breviter cylindraceo-ellipsoideae, subtilissime et breviter verrucosae. Europa. **Crepidotus variabilis** (Pers. ex Fr.) Quél.
- 72b Sporae 6–7.2 × 3–3.7 μ , ellipsoideae, ad apicem angustatae, basi oblique contractae, subtiliter aculeato-verrucosae, fere argillaceo-fuscae. Probabiliter solum varietas speciei praecedentis. Europa borealis. **Crepidotus microsporus** (Karsten) Pilát.
- 73a Sporae plerumque plus quam 10 μ longae. 74
- 73b Sporae plerumque minus quam 10 μ longae. 76
- 74a Pileus 10–30 mm. latus, pallide luteo-ochraceus, dein magis laete luteus, adultus expallescens, centro haud raro ochraceo-citrinus. Sporae 8–11 (13) × 4–5.5 μ , elongato-ellipsoideae, subtilissime punctatae, plerumque una gutta oleosa praeditae. (*C. luteolus* Lamb.) Europa.
- Crepidotus terricola** Britz. sensu Favre.
- 74b Pileus albus. 75
- 75a Pileus 8–20 mm. latus, albus, tomentoso-pilosus. Lamellae albiae, dein ferrugineae. Sporae 9.8–10.5 × 5.3–6 μ , subtilissime punctatae, fuscidulo-mellinae. America borealis: New York. Non dubito quin haec species cum praecedenti identica sit. **Crepidotus versutus** Peck sensu Singer.
- 75b Pileus 20–40 mm. latus, superficie albus vel albidus, subtiliter sericeus, radialiter rugosus vel plicatus, postice erecte pilosus. Lamellae albae, dein ferrugineae, sat latae. Sporae 10.2–10.4 × 5.3–6.5 μ , subtilissime verrucosae. A *C. terricola* Britz. pileo albo et magnitudine discrepat. Teste Singer cum *C. pubescenti* Bres. (= *C. Bresadolae* Pilát) identicus est, sed specimina europaea speciei commemoratae pileum haud rugosum vel lobatum et sporas laeves habent. America borealis: Seattle, Washington. **Crepidotus submollis** Murr.

76a Pileus plerumque minor quam 5 mm.

77

76b Pileus plerumque major quam 5 mm.

78

77a Ad muscos vivos occurrit. Pileus 2-4 mm. latus. Sporae elongato-fusoideo-ellipsoideae, subtiliter sed distincte verrucosae, $7-8 \times 3.5-3.8 \mu$, quam in *C. epibryo* Fr. angustiores et obscurius coloratae. Europa.

Crepidotus muscigenus Velenovský.

77b Ad ramulos emortuos *Juniperi communis* invenitur. Pileus 1-3 mm. latus, conchiformis, non stipitatus. Sporae late ovoideo-amygdaliformes, distincte verrucosae, $8-10 \times 5.6-6 \mu$, luteoferrugineae, nonnullae una gutta oleosa praeditae. Europa.

Crepidotus Velenovskýi Pilát.

78a Sporae subtilissime usque indistincte verrucosae.

79

78b Sporae distincte verrucosae.

80

79a Sporae late ellipsoideo-amygdaliformes, subtilissime verrucosae, pallide argillaceae, $7-9.5 \times 5.5-6 \mu$. *C. Lundellii* Pilát similis, sed sporis subtilissime verrucosis diversus. A *C. epibryo* Fr. carposomatibus compactoribus, exsiccatione minus macrescentibus et lamellis absque tinctu debili rubeolo-ferrugineo discrepat. Praecipue ad corticem *Robiniae pseudacaciae*. Europa.

Crepidotus subverrucisporus Pilát.

79b Sporae ellipsoideae, paulum et indistincte verrucosae, pallide argillaceo-fuscae. Pileus orbiculari-reniformis, lateraliter adnatus, 5 mm. latus, superficie parce tomentoso-pilosus, argillaceo-isabellinus, absque stipite substrato mycelio byssaceo, albedo, adnatus. Tasmania.

Crepidotus leptomorphus (Berk.) Sacc.

80a Sporae $7.5-10 \times 4.5-5.5 \mu$, amygdaliformes, distincte aspere verrucosae, absque guttis oleosis. Ad ligna putrida, saepe in societate muscorum. Europa.

Crepidotus epibryus (Fr.) Quél.

80b Sporae $6-7.5 \times 5-5.7 \mu$, breviter ovoideae, subtiliter sed distincte verrucosae, aculeatae, pallide argillaceo-ferrugineo-fuscae, absque guttis oleosis. Ad muscos vivos vel ad terram arenosam inter muscos. Europa.

Crepidotus subepibryus Pilát.

81a Pileus 4-15 mm. latus, primum stipite debili instructus, dein uno puncto adnatus, albus, habitu *C. variabilis* similis. Lamellae subcrassae, albae, eburneo-albidae, dein pallide ochraceae tinctu debili rosaceo. Sporae in cumulo rosaceae. Sporae sub microscopo hyalinae, ellipsoideo-amygdaliformes, quinque usque octo costis longitudinalibus sat distinctis ornatae, qua de causa spora in sectione optica horizontali ut distinctus 5-8 angulus proiciatur. Europa. *Crepidotus* (*Octojuga*) *variabilis* Fayod non Fries nec Persoon, *Octojuga pleuroteloides* Kühner, *Octojuga Fayodi* Konr. & Maubl., *Clitopilus pleuroteloides* (Kühner) Jossierand, *Pleurotus romellianus* Pilát) **Clitopilus chioneus** (Pers.) Pilát.

81b Pileus 15-40 mm. latus, semiorbicularis vel flabelliformis, ad basin cuneato-contractus, candidus vel sublutescens, saepe margine lobatus. Lamellae albae, dein ochraceae tinctu rosaceo. Sporae in cumulo subroseae. Sporae ellipsoideo-amygdaliformes, costis transversalibus exiguis ornatae, qua de causa in sectura optica horizontali ut parum distinctus 7-8 angulus proiciuntur, $7.5-9 \times 4.6-5.3 \mu$. Europa. (*Claudopus pseudopinsitus* Kühner?, *Pleurotus passeckerianus* Pilát).

Clitopilus pinsitus (Fr.) Jossierand.

STUDIES ON THE GENUS *MASTIGOSPORIUM*I. GENERAL ACCOUNT OF THE SPECIES AND
THEIR HOST RANGESBy E. G. BOLLARD, *Botany School, University of Cambridge*

(With 4 Text-figures)

INTRODUCTION

Mastigosporium is a genus of Hyphomycetes whose species are known only as parasites causing leaf spot diseases of grasses. The genus is characterized by large, hyaline, slimy, septate conidia borne on short conidiophores. Four species have been described.

(1) *Mastigosporium album* Riess. This is the type species (Fresenius, 1852). The conidia are 4- or 5-septate, and bear one or more filiform appendages at their distal ends. This species is locally common in Europe and Great Britain. It has been most frequently recorded on *Alopecurus pratensis*, but has also been found on *A. nigricans* (Stapledon & Jenkin, 1922), various species of *Alopecurus* (Jørstad, 1945), *Cynosurus cristatus* (Pethybridge, Moore & Smith, 1934) and *Deschampsia caespitosa* (Sampson & Western, 1942). Lindau (1907) has recorded this species from no fewer than nineteen species, but Sprague (1938) does not regard all these records as valid.

(2) *Mastigosporium rubricosum* (Dearn. & Barth.) Sprague. Sprague (1938) established the synonymy of *M. album* var. *calvum* (Davis, 1903), *M. album* var. *muticum* (Saccardo, 1911), *Fusoma rubricosa* (Dearness, 1917), and *Amastigosporium graminicola* (Bondarzeva-Monteverde, 1921), and included them in the new species *Mastigosporium calvum*. To conform with the International Rules of Botanical Nomenclature, Sprague (1940) later changed its name to *M. rubricosum*. The conidia are shorter than those of *M. album*, possess only 3 septa and are muticate. This species has been recorded from Europe, Great Britain and U.S.A. as widespread and common. It has been found on *Dactylis glomerata*, *D. ascherssoniana*, various species of *Agrostis* and *Calamagrostis*, *Trisetum cernuum* and *Phleum pratense* (Sprague, 1938, 1940, 1946, 1948; Sampson & Western, 1942; Jørstad, 1945).

(3) *Mastigosporium cylindricum* Sprague. Sprague (1940) described *M. cylindricum* as occurring only on *Bromus vulgaris* (Hook.) Shear in a restricted area of Oregon, U.S.A. This species is characterized by 3-septate, muticate conidia which are not only smaller than those of *Mastigosporium rubricosum* but are regularly cylindrical in shape rather than elliptical.

(4) *Mastigosporium deschampsiae* Jørstad. Jørstad (1947) has recently described this species on *Deschampsia caespitosa* in Norway. The species is distinguished by large elliptical spores, rounded or tapering at the apex, with 4-7 (mainly 6) septa.

In his revision of the genus, Sprague (1938) relegated *Mastigosporium*

lupini (Sor.) Cav. (Cavara, 1924) and *M. album* var. *athrix* Erikss. (Eriksson, 1891) to other genera.

No perfect stage has been found for any of the species. Fuckel (1869) suggested that *M. album* and *Dilophospora alopecuri* might be two stages of the same fungus, linking them at the same time with the ascomycete *Dilophia graminis* (Fuck.) Sacc. Other authors (e.g. Eriksson, 1936) have supported this suggestion. Rainio (1936) claimed to have established the relationship by both cultural and inoculation experiments. However, neither Sprague (1938) nor Sampson & Western (1939) could find any such connexion, and my observations agree with theirs.

In the present work observations have been made on *Mastigosporium album*, *M. rubricosum* and *M. cylindricum*, and the diseases caused by them. The last-named fungus is recorded from Great Britain for the first time. It is proposed to restrict the name *M. rubricosum* to the fungus on *Dactylis*, while *Mastigosporium rubricosum* var. *agrostidis* has been designated as a new variety. *M. deschampsiae* has not been found in Great Britain and will not be mentioned further.

FIELD OBSERVATIONS

Observations on the occurrence of these fungi, particularly around Cambridge, were made between November 1945 and March 1948. Through the courtesy of the Director, grass plots were examined at the Welsh Plant Breeding Station, Aberystwyth, in April and September 1947.

Distribution in Great Britain

Numerous records of these species in Britain have been made in the past. I have recorded *Mastigosporium album* on *Alopecurus pratensis* only at Aberystwyth. On the other hand, *Mastigosporium rubricosum* was observed wherever *Dactylis glomerata* occurred, and once on *Agrostis stolonifera*. At Aberystwyth my interest was aroused by the similarity of spots on the leaves of *Phleum nodosum* to those on *Dactylis glomerata* due to *Mastigosporium rubricosum*; the fungus proved to be a species of *Mastigosporium* agreeing with the American description of *M. cylindricum*.

Disease symptoms

The diseases caused by species of *Mastigosporium* are given various common names, viz. 'leaf spots' (Dennis & Foister, 1942); 'eye-spots' or 'brown spots' (Sprague, 1946); 'leaf-flecks' (Plant Pathology Committee, 1944).

Sprague (1938) and Sampson & Western (1942) have described the symptoms. The disease takes the form of numerous brown or black necrotic spots on the leaf blades and, less frequently, the leaf sheaths. The flowering stalks or heads are not attacked. The individual lesions are elliptical and 3-6 mm. long. The essential feature is the production of numerous discrete lesions; general necrosis of the leaf tissue does not occur.

M. album has been previously reported by Sampson (1924), Sampson & Western (1939, 1942), and Stapledon & Jenkin (1922) as causing considerable damage to *Alopecurus pratensis* at Aberystwyth, particularly in late

autumn and early spring. My observations fully confirm this. Every plant of several hundred inspected was badly attacked, many of the plants having over half their leaves covered with spots. This disease has not received much attention, possibly because it is not widespread throughout the country, but it would seem to be a potentially serious one.

Mastigosporium rubricosum has been reported by Sprague (1938, 1946), Stapledon & Jenkin (1922), and Sampson & Western (1942) as the cause of a serious leaf spot of *Dactylis glomerata* and species of *Agrostis*. I rarely found plants of *Dactylis glomerata* which did not show signs of attack throughout the year, with peaks of intensity in early spring and late

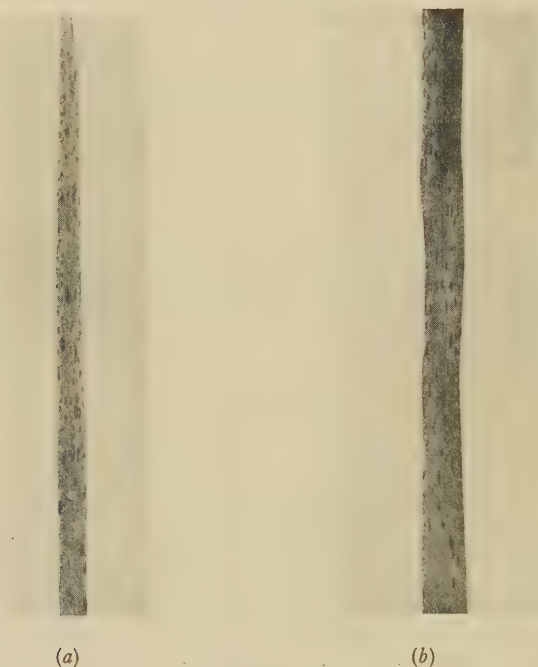


Fig. 1. Disease symptoms: (a) *Mastigosporium album* on *Alopecurus pratensis* ($\times \frac{1}{2}$);
(b) *Mastigosporium rubricosum* on *Dactylis glomerata* ($\times \frac{1}{2}$).

autumn. This fungus exists in at least two forms, one on *Dactylis* and the other on *Agrostis*. The form on *Dactylis glomerata* is widespread throughout the country and causes one of the most serious diseases of this grass. The form on *Agrostis* is less widespread, but also causes a severe disease.

Thus, under suitable conditions all these diseases cause considerable destruction of the foliage. No estimate can be given of their effect on seed production.

Spore production and dissemination

The conidia are borne on conidiophores which emerge directly from the leaf tissue. They appear in the centre of the dark lesions as a small glistening white mass, just visible to the naked eye. Conidia are rarely found in the

field, but, if leaves bearing lesions are removed from the plant at any time of the year and are placed in dishes with moist filter-paper and kept at laboratory temperatures, conidia appear on most leaves within twenty-four hours. A second crop could never be obtained on lesions from which the first crop had been removed.

The genus *Mastigosporium* is included in the slimy-spored forms of the Hyphomycetes (Wakefield & Bisby, 1941). The spores are well adapted for water-dispersal, e.g. by splashing in rain or by dew drops running along a leaf blade, and they lose their vitality on desiccation.

Over-summering

During a cool, wet summer, such as that of 1946, the level of infection of *Dactylis glomerata* by *Mastigosporium rubricosum* may remain practically constant. On the other hand, a hot dry summer, such as that of 1947, leads to a marked reduction in the amount of infection. Young lesions, formed at the onset of a hot dry period, can apparently survive and produce spores when conditions again become favourable. It is unlikely that the spores themselves play any part in the over-summering of this fungus.

Over-wintering

Collections of diseased leaves of *Dactylis glomerata* made throughout the year always yielded some conidia, e.g. in March 1947 diseased leaves collected from plants that had been under snow for six weeks yielded viable conidia when brought into the laboratory. It is evident that the fungus can over-winter as viable mycelium in lesions and can produce conidia when favourable conditions return. It is not known whether conidia liberated in the autumn can over-winter if they are not subjected to desiccation, or how long mycelium can remain viable in a lesion. Dark spots, which are clearly old lesions due to *Mastigosporium rubricosum*, are often present on dead leaves. Efforts to induce such old lesions to produce conidia have been unsuccessful. Even if hyphae remain viable in them, they are unlikely to play any part in the over-wintering of the fungus.

Examination of moribund and dead leaves of *Dactylis glomerata* bearing *Mastigosporium* leaf spots has given no evidence of the occurrence of a perfect stage. If such a stage exists in nature it must be relatively rare and does not play any regular part in over-wintering.

EXPERIMENTAL WORK

Host species and fungus isolations

Numerous species of grasses, including many strains of *Dactylis glomerata*, were grown in an unheated greenhouse for experimental purposes. Most were grown from seed but a few were established vegetatively from wild plants.

Species of *Mastigosporium* were isolated as follows:

M. album. From *Alopecurus pratensis* at Aberystwyth, December 1946.

Mastigosporium rubricosum. Four isolations were made: (a) November 1945 from *Dactylis glomerata* at Cambridge; (b) August 1946 from the same host at Harpenden; (c) September 1946 from the same host near Whitby, Yorkshire; and (d) April 1947 from *Agrostis stolonifera* at Aberystwyth.

Mastigosporium cylindricum. From *Phleum nodosum* at Aberystwyth, April 1947.

Efforts to obtain American isolations of the last two species for comparative purposes were unsuccessful.

Methods

Isolation

The fungi were isolated by the dilution series technique, using a spore suspension from a mass of conidia on a lesion.

Preparation of grass-extract media

Grass-extract media were used for the routine culturing of the fungi. They were prepared as follows: 100 g. of green leaves of the particular grass species were chopped up and extracted in 1000 ml. of distilled water by steaming for three hours. The resulting extract, after filtration, is a clear dark brown liquid of about pH 6.0. Only agar is added.

Preparation of spore suspensions for inoculation

For the production of spores for inoculation purposes seven to nine colonies of a fungus were grown in each Petri dish. The slimy masses of spores produced in the centre of each colony were removed with a scalpel and mixed into sterile distilled water.

Inoculation

Leaves were marked with indian ink and the spore suspension was placed between the marked lines with a camel-hair brush. The pots containing inoculated plants were immediately placed in trays of water and covered by bell jars for forty-eight hours. When the leaves had a heavy waxy 'bloom' they were drawn gently between the fingers before inoculation. This procedure allowed the spore suspension to be spread evenly.

Study of spore germination

The spores were suspended in drops of liquid on sterilized slides kept in Petri dishes containing moist filter-paper. The slides were placed on angle pieces of glass rod to keep them off the wet paper. Germination was measured by counting spores in several random fields and noting the number which had germinated. Usually a hundred spores were counted in each test. This method was preferred to the hanging-drop technique. When the spores are suspended in a hanging drop they sink to the bottom of the drop and mass together, thus hindering observation.

Growth-rate tests

Tubes containing exactly 20 ml. of the various media were prepared. These were poured into uniform Petri dishes, thus ensuring an equal depth

of medium in each dish. Each dish was inoculated from the same fungus culture. The inoculum was a cylindrical piece of agar containing hyphae, cut with a cork-borer from the actively growing periphery of the parent colony. Each 'cylinder' of agar was inverted on the new agar surface to ensure that the hyphae were in immediate contact with the medium. On the underside of each dish two lines were drawn at right angles, their points of intersection being the point of inoculation, i.e. in the centre of the new colony. At intervals readings were made of each colony by recording the lengths of two diameters, measured along the marked lines. The mean of these two diameters was used as a measure of the growth of the colony.

Culture studies

Sprague (1938) and Sampson & Western (1939) grew *Mastigosporium album* and *M. rubricosum* in pure culture. In the early stages of the present work the isolates were grown on Dox, 2% malt, and potato dextrose agars. Growth was slow, the average colony diameter being only 16 mm. after four weeks at laboratory temperature. On grass-extract agars growth was slightly faster, an average diameter of 21 mm. being attained in the same time. In addition, sporulation was much more abundant on these media. By adding various additional nutrients to the extract the rate of growth could be increased, but only at the expense of sporulation. For these reasons an extract of leaves of *Dactylis glomerata* was thereafter used almost exclusively for culturing the isolates.

Descriptions of colonies

On *Dactylis* extract agar all the isolates produced similar colonies. They are brown in colour with scarcely any aerial hyphae, though young colonies of *Mastigosporium cylindricum* may produce some white ones. Conidia are produced in a moist slimy pile in the centre of each colony. Under unfavourable conditions, such as rich media or at temperatures of 20° C. or over, very few conidia are produced. Under normal conditions cultures of *M. cylindricum* produce fewer conidia than the other species. Prolonged keeping of all isolates in culture has not affected their virulence in attacking the host. Experiments have revealed differences in the growth rates of the isolates. Table 1 gives the average diameter attained by colonies after twenty-one days' growth. The growth rates of *M. album* and *M. cylindricum*

Table 1. Average diameter of fifty colonies of four isolates of *Mastigosporium* after twenty-one days' growth on *Dactylis* extract medium at laboratory temperatures

Species	Mean diameter of colonies in mm.
<i>M. album</i>	10.50
<i>M. rubricosum</i> (ex <i>Dactylis glomerata</i>)	16.60
<i>M. rubricosum</i> (ex <i>Agrostis stolonifera</i>)	13.55
<i>M. cylindricum</i>	10.79

are not significantly different, but they differ from those of the two isolates of *M. rubricosum* which also differ from each other.

Sclerotia

Sprague (1938) recorded 'small partially embedded stromatic or sclerotic mycelia that resemble pycnidia' in colonies of *M. rubricosum*. I have seen similar bodies in older colonies of *M. album* and in both isolates of *M. rubricosum*. They appeared first in cultures a month old and their appearance was correlated with the onset of cooler temperatures.

Individually these structures from the two species do not appear to differ. Each is a small spherical body with a diameter of 200–350 μ . In some a definite opening or 'ostiole' has been seen. The wall is composed of closely compacted hyphae and is tough, e.g. when pressed under a cover-slip it resists pressure and then suddenly breaks. No trace of spore formation has been seen, though on squashing oil or fat globules are liberated. This may indicate a massing of food material prior to spore production. Various unsuccessful efforts were made to encourage further development, e.g. yeast extracts were added to the media. Culture plates in which numbers of these bodies had begun to form were also wrapped in water-proof cellulose film: this procedure slows down evaporation, and plates were kept for periods of up to four months without drying out.

If these structures are regarded as incipient perithecia it is possible that further development might not occur without the intervention of another strain of the same fungus. To test this the three different isolates of *M. rubricosum* from *Dactylis glomerata* were grown together in all possible combinations of two. In addition each isolate was grown with the isolate of *Mastigosporium rubricosum* from *Agrostis stolonifera*. In all these dual cultures normal 'sclerotia' were formed, but no further development occurred.

Spore formation

By teasing in water some of the surface mycelia from young colonies all stages in spore formation can readily be observed. A slight swelling appears at the tip of a vegetative hypha. A septum then appears cutting off the tip from what will be the conidiophore. This swollen tip then elongates and swells laterally. A transverse septum now appears in the spore itself. Further elongation and swelling of the spore occurs, followed by the appearance of two more transverse septa, usually simultaneously. The conidiophores may also become septate. With *Mastigosporium rubricosum* and *M. cylindricum* the spore has attained its maximum size once 3 septa have appeared. In *M. rubricosum* the mature spore occasionally possesses 4 or 5 septa. In *M. album*, once the spore is 3-septate, the distal end is drawn out into a long tapering projection. Further slight elongation occurs, and another septum appears, dividing the terminal segment. Occasionally 5-septate spores are seen. The terminal process may branch slightly. Other similar processes may be produced from nearby points, or even from the penultimate segment of the spore. The processes are quite rigid in the mature spore and show great variation in actual arrangement.

Drying of the spores

Drops of spore suspensions were placed on sterile slides and allowed to dry slowly. Immediately afterwards drops of a nutrient solution were placed on the dried spores. Observations were made at intervals of up to a week,

but germination was not observed. Control spores from the same cultures germinated readily in the same nutrient. It would appear that the spores are killed on drying, and that successive infections can proceed only when there is no desiccation of the spores between the time of their formation and leaf infection.

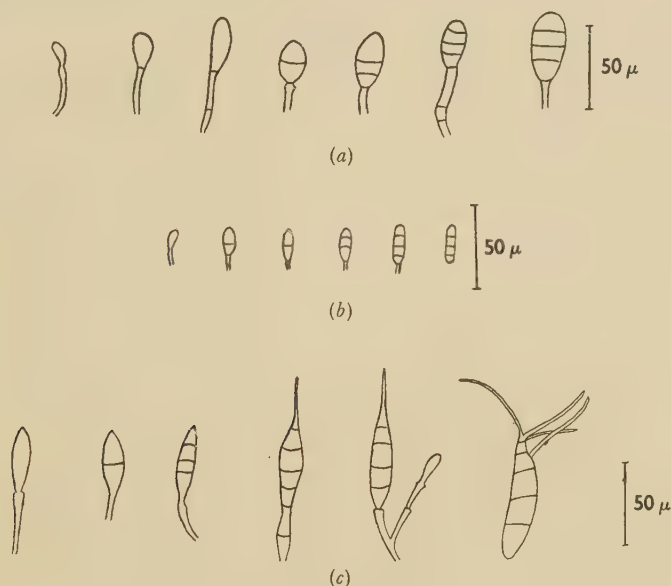


Fig. 2. Spore formation: (a) *Mastigosporium rubricosum*, (b) *M. cylindricum*, (c) *M. album*.

Comparison of conidia produced in culture and on the host

The conidia produced in culture by each species of *Mastigosporium* are morphologically characteristic but the spore size varies, and this variation was studied more closely. The lengths of 100 spores of each isolate produced in culture and on naturally diseased leaves were measured to the nearest 2μ while the spores were suspended in water, with the following results:

M. album

From leaves $47-69\mu$, mean 59.62μ (s.d.* 4.21).

From culture $43-67\mu$, mean 52.54μ (s.d. 4.97).

M. rubricosum (ex *Dactylis glomerata*)

From leaves $31-59\mu$, mean 42.74μ (s.d. 5.38).

From culture $33-51\mu$, mean 43.34μ (s.d. 3.52).

M. rubricosum (ex *Agrostis stolonifera*)

From leaves $35-45\mu$, mean 40.65μ (s.d. 2.46).

From culture $35-53\mu$, mean 42.44μ (s.d. 4.02).

M. cylindricum

From leaves $19-27\mu$, mean 23.00μ (s.d. 1.89).

From culture $17-31\mu$, mean 24.38μ (s.d. 3.00).

* s.d. = standard deviation.

The significance of the differences in spore length has been calculated by using the 't' test described by Mathur (1943).

The spores of *M. album* are significantly shorter, and the spores of *M. rubricosum* (from *Agrostis stolonifera*) and of *Mastigosporium cylindricum* significantly longer than the corresponding spores from leaves. There is no significant difference in length between the spores of *M. rubricosum* (from *Dactylis glomerata*) from leaves and cultures.

Comparison between the two isolates of *Mastigosporium rubricosum* from different hosts is interesting. The mean length of spores from leaves of *Dactylis glomerata* is just significantly greater than that from leaves of *Agrostis stolonifera*, but the difference, $2.09\ \mu$, is too small to be of practical use.

These results show that the spores of the three species are different in length. The fact that an isolate growing in culture sometimes produces conidia which are significantly different in length (sometimes shorter and sometimes longer) than those produced by the same isolate on its host shows the need for care in comparing spore sizes given by different writers. Full knowledge of the conditions under which the spores were produced is essential before valid comparisons can be made. It is noteworthy that Elliott (1948) has found that the size and septation of the conidia produced in culture by *Helminthosporium victoriae* are partly dependent on the carbohydrate concentration in the medium.

Sprague (1938) has tabulated the range of conidial length of a number of collections of both *Mastigosporium album* and *M. rubricosum*, and these show good agreement with the ranges now recorded. Sprague (1940), in his description of *M. cylindricum*, give a range of spore length of $25\text{--}32\ \mu$. The range of spore length of this fungus parasitizing *Phleum nodosum* described in the present investigation was $17\text{--}31\ \mu$. The spores had the typical cylindrical appearance of the spores from *Bromus vulgaris* and there is little doubt that the two fungi correspond very closely morphologically.

Temperature relations of the fungi in culture

The effect of temperature on spore germination and on hyphal elongation was studied in culture.

Effects of temperature on spore germination. Conidia were suspended in grass extract. The densities of the suspensions were approximately equal. Spore germination tests were set up as previously described. The Petri dishes were kept in controlled temperature chambers at 5, 10, 15, 20 and 25°C . After forty-eight hours random fields on each slide were examined until 100 spores on each had been counted. The number out of these 100 spores which had germinated in each case was noted. The results are given in Fig. 3.

The conidia of *Mastigosporium album* germinate well over the range $5\text{--}15^{\circ}\text{C}$., while some germination occurs at 20°C .

The conidia of both isolates of *M. rubricosum* germinate well at 15 and 20°C ., with some germination at 5°C .

Of particular interest is the fact that no germination of spores of either species occurs at 25°C .

Effects of temperature on mycelial growth. A growth-rate test, as previously described, was set up. The medium used was *Dactylis* extract. Eight plates of each fungus were kept at 5, 10, 15, 20 or 25°C . The colony

diameters were measured after six days' growth. From the mean colony diameter 1.5 mm. was subtracted, this being the diameter of the agar cylinder of inoculum. The new figure gave the mean increase in diameter in each colony in the six days at different temperatures. These figures are plotted in Fig. 4.

Mastigosporium album shows some growth at 5° C., and at 25° C., but grows best over the range 10–20° C.

M. rubricosum (from *Dactylis glomerata*) shows no growth at 5 or 25° C. Best growth occurs at 20° C.

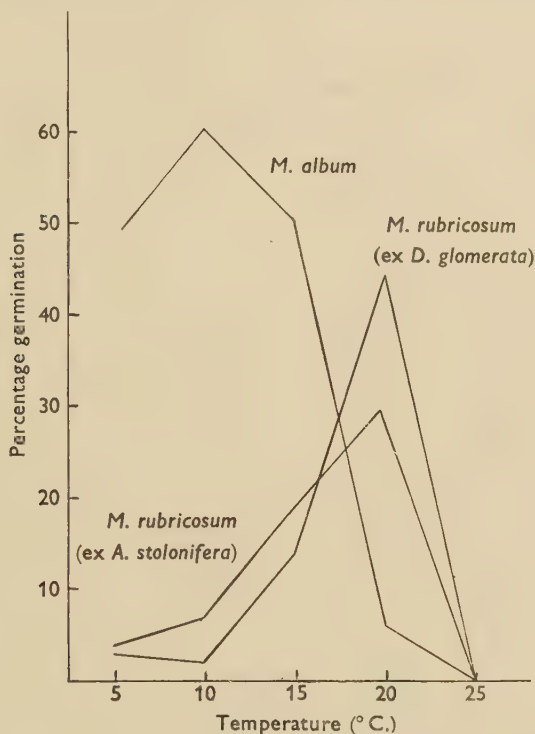


Fig. 3. Percentage germination of spores of species of *Mastigosporium* at different temperatures.

Mastigosporium rubricosum (from *Agrostis stolonifera*) shows some growth at 5 and 25° C., but grows best from 10 to 20° C.

Mastigosporium cylindricum grows reasonably well over the range of temperatures tested with an optimum at about 20° C.

It is difficult to translate these laboratory results to field conditions where temperatures fluctuate, but if it is assumed that no germination occurs when the average temperature much exceeds 20° C., then there are periods when no attack can take place. At the other end of the scale some development of the disease may occur at temperatures as low as 5° C.

Inoculation studies

Development of symptoms

In all instances the development of symptoms follows very much the same course. The first visible sign of infection is the development, three or four days after inoculation, of minute water-soaked areas on the leaf. Within twenty-four hours tiny brown flecks appear in these areas. These brown flecks enlarge rapidly and by the sixth or seventh day the leaves are showing full-sized lesions. If the inoculated plants are kept under suitable humid conditions, spores are produced on the lesions within seven to twelve days.

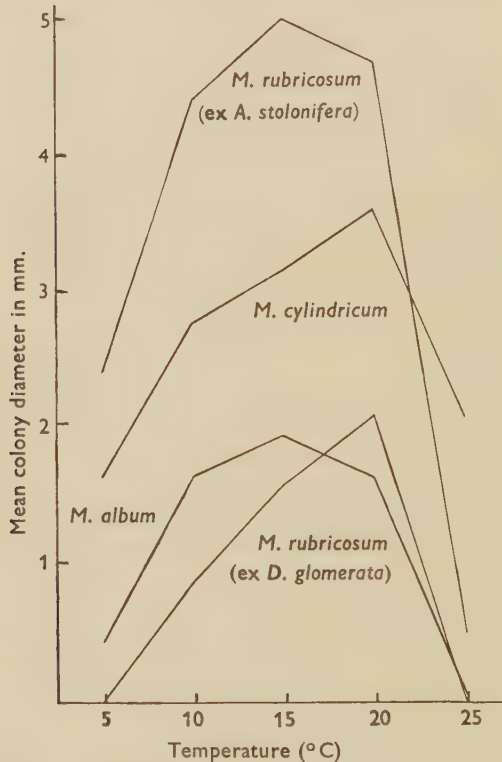


Fig. 4. Growth of *Mastigosporium* species at different temperatures (six days).

Effects of leaf age and structure on infection

Disease symptoms were produced equally readily whether the spore suspension was placed on the upper or lower leaf surface. Under natural conditions, however, the upper surfaces of many grass species are ridged and very difficult to wet, and it would seem likely that most infection occurs through the lower epidermis.

In some of the hosts the old leaves are thicker and possess a much thicker cuticle than the young leaves, but in inoculation experiments symptoms appeared just as soon on the old leaves, and the final intensity of attack was as great as on the young ones.

Susceptibility of different strains of Dactylis glomerata

Plants of five Aberystwyth, one American, one Danish and one New Zealand strain of *Dactylis glomerata* were all inoculated with *Mastigosporium rubricosum*. No difference in susceptibility could be detected, every plant tested was susceptible, and the intensity of infection seemed to be proportional only to the spore load applied.

Host ranges

Table 2 gives the result of a series of inoculations carried out to determine the host ranges of the different species of *Mastigosporium*.

Table 2. *Results of inoculating ten plants of a number of grass species with Mastigosporium album, an isolate of Mastigosporium rubricosum from Dactylis glomerata and one from Agrostis stolonifera, and Mastigosporium cylindricum.*

(× = all plants susceptible; o = no plants susceptible.)

	Inoculated with			
	<i>M. album</i>	<i>M. rubricosum</i> (ex <i>D. glomerata</i>)	<i>M. rubricosum</i> (ex <i>A. stolonifera</i>)	<i>M. cylindricum</i>
<i>Alopecurus agrestis</i>	o	o	o	o
<i>A. geniculatus</i>	×	o	o	o
<i>A. pratensis</i>	×	o	o	o
<i>Dactylis aschersoniana</i>	o	×	o	o
<i>D. glomerata</i>	o	×	o	o
<i>Agrostis canina</i>	o	o	o	o
<i>A. gigantea</i>	o	o	o	o
<i>A. stolonifera</i>	o	o	×	o
<i>A. tenuis</i>	o	o	o	o
<i>Phleum nodosum</i>	o	o	o	×
<i>P. pratense</i>	o	o	o	×
<i>Calamagrostis canescens</i>	o	o	×	o
<i>C. epigejos</i>	o	o	×	o
<i>Deschampsia caespitosa</i>	o	o	o	o
<i>Brachypodium pinnatum</i>	o	o	o	o
<i>B. sylvaticum</i>	o	o	o	o
<i>Trisetum flavescens</i>	o	o	o	o
<i>Cynosurus cristatus</i>	o	o	o	o
<i>Lolium multiflorum</i>	o	o	o	o
<i>L. perenne</i>	o	o	o	o

The following points are worthy of note:

Mastigosporium album. Although all plants of *Alopecurus pratensis* and *A. geniculatus* were fully susceptible, all plants of *A. agrestis* tested were completely resistant. Sprague (1938) reported *Deschampsia caespitosa* and *Brachypodium pinnatum* as hosts for this species, but I could not infect these grasses. As Sprague's culture and my isolate both came from diseased material at Aberystwyth these differences in host range are perhaps to be attributed to differences in the host plants inoculated rather than to differences in the pathogenicity of the two isolates.

Mastigosporium cylindricum attacks only *Phleum nodosum* and *P. pratense*. *Bromus vulgaris* was not available, and until comparative inoculations are made it is uncertain whether the present isolate and the American fungus are identical.

Mastigosporium rubricosum. The host ranges of the three isolates of *M. rubricosum* from *Dactylis glomerata* appear to be identical; they attack only the two species of *Dactylis*. In particular, *Agrostis stolonifera* was not attacked. The isolate from *A. stolonifera* attacked only *A. stolonifera* and the two species of *Calamagrostis*. *Agrostis canina*, *A. tenuis*, *A. gigantea*, *Trisetum flavescens*, and *Phleum pratense*, were resistant to all isolates of *Mastigosporium rubricosum*.

Sprague's observation that this species probably exists in different forms is thus confirmed. On the evidence available the present isolates of *M. rubricosum* from *Dactylis glomerata* are similar to Sprague's: the only plants they attack are species of *Dactylis*. On the other hand, my isolate from *Agrostis stolonifera* differs from Sprague's isolation from *A. alba* in two ways: (i) Sprague's isolate attacked *Dactylis glomerata* whereas my isolate does not attack *D. glomerata* or *D. ascherssoniana*. (ii) Sprague's isolate attacked *Agrostis tenuis* while mine does not.

These differences may be due to differences in the genetic constitution of the host material and it would be necessary to inoculate the same host material with both isolates to determine identity or otherwise.

To complete the picture it would be necessary to compare isolates from the species of *Trisetum* and *Phleum*, on which *Mastigosporium rubricosum* occurs naturally in the United States.

COMPARISON OF THE ISOLATES OF *MASTIGOSPORIUM RUBRICOSUM*

A detailed comparison was made of isolates of this species from *Dactylis glomerata* and from *Agrostis stolonifera*. Growth in culture is very similar; the details of spore development are identical; and mature spores, whether formed in culture or on naturally diseased material, are very similar as regards septation, shape, etc.

There are, however, distinct differences between the two isolates:

- (i) The host range of each is distinct.
- (ii) Although the spore shapes, etc., are identical, slight but significant differences do exist between the mean spore lengths, though these can be detected only when spores produced on diseased leaves are compared.
- (iii) Slight differences exist in pure culture. For instance, the isolate from *A. stolonifera* consistently produces a much greater bulk of conidia and a much larger number of 'sclerotia'.
- (iv) Under the experimental conditions described there are differences in growth rate, and in the minimum, optimum and maximum temperatures.

It is evident that the two isolates are different forms of one species. I propose to retain the name *Mastigosporium rubricosum* for the fungus attacking species of *Dactylis*, and to designate the fungus attacking *Agrostis stolonifera* as a new variety, *Mastigosporium rubricosum* var. *agrostidis*.

***Mastigosporium rubricosum* var. *agrostidis* Bollard var. nov.**

A typo differt conidiis paulum brevioribus, longitudine media ex hospite *Agrostide stolonifera* 40.65 (42.74 in typo ex *Dactylide glomerata*): mycelio in cultura conidia et sclerotia plura prodenti: hab modo in foliis vivis *Agrostidis stoloniferae*, Aberystwyth.

SUMMARY

Species of *Mastigosporium* cause leaf-spot diseases of certain grasses.

In Great Britain, *M. album* is of local occurrence on *Alopecurus pratensis*. In experimental inoculations it also attacked *A. geniculatus* but not *A. agrestis*.

Mastigosporium cylindricum was found in Britain for the first time on *Phleum nodosum* in the field, but it also attacks *P. pratense*.

Mastigosporium rubricosum is widespread in Britain on *Dactylis glomerata* to which it sometimes causes severe damage. It also attacks *D. ascherssoniana* but not *Agrostis*. Different strains of *Dactylis glomerata* are equally susceptible.

M. rubricosum var. *agrostidis*, which attacks *Agrostis stolonifera*, has been designated as a new variety on pathogenic, cultural and morphological grounds. It also attacks species of *Calamagrostis* but not *Dactylis glomerata* or other species of *Agrostis*.

The slimy-walled conidia produced on lesions are probably water-dispersed as they cannot withstand desiccation. The spread of disease is favoured by cool moist conditions.

The fungi probably over-winter and over-summer as viable mycelium in lesions. They are relatively slow growing in culture. No perfect stage has been described but perithecia-like structures (sclerotia) which never mature are produced in culture.

The optimum temperature for spore germination and mycelial growth of all species is about 15° C. At 20° C. some development occurs, but above this temperature growth ceases.

This work was carried out in the Botany School, Cambridge. I wish to express my thanks to Prof. F. T. Brooks, who suggested this investigation, for much helpful encouragement and criticism.

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STUDIES ON THE GENUS *MASTIGOSPORIUM*

II. PARASITISM

By E. G. BOLLARD, *Botany School, University of Cambridge*

(With 3 Text-figures)

In a previous paper (Bollard, 1950) the species of the genus *Mastigosporium* and the diseases they cause have been described. In this paper an account of the mode of parasitism of these fungi is given.

MODE OF ATTACK

Infection of the host

A histological investigation of the host-parasite relations during the initiation of infection by *Mastigosporium album* on *Alopecurus pratensis*, *Mastigosporium rubricosum* on *Dactylis glomerata*, and *Mastigosporium rubricosum* var. *agrostidis* on *Agrostis stolonifera* has been carried out. Two procedures were used :

Examination of entire portions of leaves

Portions of inoculated leaves were fixed in a mixture of glacial acetic acid (1 part) and absolute alcohol (3 parts) for twenty-four hours. They were transferred to 50 % alcohol and then water, stained in cotton blue for thirty minutes and mounted in lactophenol. This method has been useful in studying the earliest stages of infection.

Sectioning of leaves

The fixative used was the chromacetic-urea mixture described by Allen (1923). To facilitate rapid penetration of the fixative the inoculated portions of leaves were placed in methylated spirit for thirty seconds immediately after removal from the plant. They were then transferred to the fixative, in which they sank after evacuation. The usual procedures were followed for dehydration and embedding in wax, chloroform being used as the solvent for the latter.

A modification of Stoughton's (1930) staining technique was used. The sections were stained for four hours in a 0.1 % solution of thionin in 5 % aqueous phenol. They were then brought quickly up the alcohol series to absolute alcohol and then counterstained in a dilute solution of orange G in absolute alcohol for ten to fifteen seconds. If the sections were kept too long in absolute alcohol or in the counterstain, most of the thionin was removed and satisfactory differentiation was not obtained.

Using these methods, inoculated leaves were examined at intervals, ranging from twenty-four hours after inoculation until the lesions were fully formed. Only slight differences between the mode of attack of the

three fungi on their respective hosts have been detected and the following description applies to each host-parasite combination.

Spore germination and penetration. The spores germinate rapidly on the leaf surface. After twenty-four hours considerable hyphal development has usually taken place. All spores which germinate do not penetrate and attack the underlying host tissue. Some germ tubes grow into normal hyphae running along the leaf surface, but do not penetrate it.

When more than one germ tube arises from a single spore of any species of *Mastigosporium* germinating on a slide they do so in a purely random manner. When the spores germinate on a leaf this random arrangement is not usually present. The germ tubes mostly arise from that part of the spore lying along the leaf surface, and it is usual for two and common for three cells to produce germ tubes; sometimes all four cells germinate. Some stimulus seems to be exerted which causes all the germ tubes to arise from that part of the spore in contact with the leaf. The hyphae seen to penetrate the epidermis have all arisen from the spores in this manner. The penetrating germ tube grows directly from the spore straight through the cuticle and wall into the cavity of the epidermal cell. There is no swelling on the surface suggestive of an appressorium. No penetration through stomata has been observed (Fig. 1).



Fig. 1. Camera lucida drawing of longitudinal section of leaf of *Dactylis glomerata* showing penetration of hyphae of *Mastigosporium rubricosum* into an epidermal cell. Twenty-four hours after inoculation ($\times 250$).

Development of the lesions. Once inside the epidermal cell the germ tube rapidly develops into an extensive mycelium. After four or five days the contents of the infected cell are dark yellow or brown in colour. These discoloured epidermal cells seem to shrink somewhat and are always full of hyphae. In surface preparations these infected cells stand out in contrast to the adjacent healthy cells.

The next stage is that the mesophyll cells immediately adjacent to the infected epidermal cell become yellow (when fresh material is examined) and their contents appear to be disorganized. The disorganized protoplasmic contents adhere to the cell wall and become dark in colour. The contents of adjacent epidermal cells may also become disorganized. It is apparent that some toxic substance, either a product of the normal metabolism of the fungus or some product of the breakdown of the first infected epidermal cell, has diffused out from the seat of infection. Most of this happens while the mycelium is still confined to the originally infected epidermal cell. A little later the hyphae grow among the disorganized mesophyll cells (Fig. 2).

The lesion extends both laterally and longitudinally, and a longitudinal section through a mature lesion shows that adjacent to healthy-looking

green cells are cells whose contents are beginning to yellow. Behind these are cells whose contents have totally collapsed and have adhered to the cell wall giving it a very dark colour. It is the aggregation of these dark-coloured walls which gives the mature lesion its dark appearance. In the centre of the lesion all tissue organization is lost and only fragments of broken-down cells remain. There is no sign of zonation; tissues showing one condition blend imperceptibly with tissues showing another.

The hyphae ramifying in the mesophyll do not extend to the edge of the lesion. There are always affected cells in advance of the furthest development of the mycelium. This conforms to the view that the toxic action on the tissue is due to a diffusible substance either from the fungus or from previously disorganized host cells. The mycelium is always rather sparsely

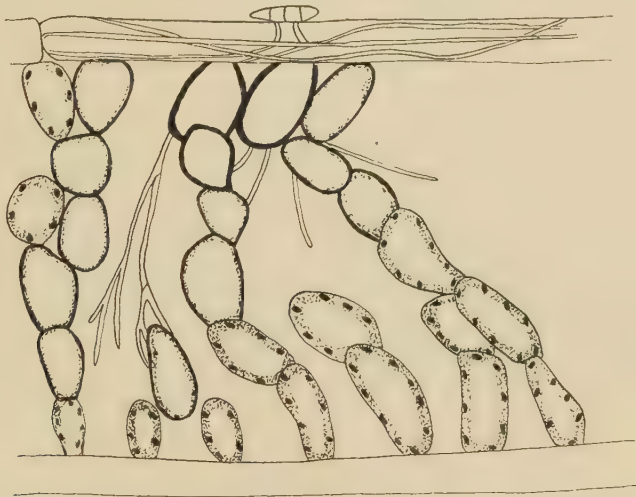


Fig. 2. Camera lucida drawing of longitudinal section of leaf of *Alopecurus pratensis* infected with *Mastigosporium album* showing stages in lesion formation reached three days after inoculation ($\times 250$).

developed in a mature lesion but the hyphae are relatively more abundant towards the edge. There are few, if any, in the central disorganized area. Towards the edge of the lesion the mycelium is entirely intercellular: where the cells have collapsed some intracellular hyphae may be seen.

Delimitation of the lesion. The symptoms are typically discrete lesions and this implies some limitation on the development of the fungus in the tissues.

In leaves of *Alopecurus pratensis*, *Dactylis glomerata* and *Agrostis stolonifera* there is undoubtedly some lateral delimitation of the spots by the closely placed longitudinal veins. These strands of vascular tissue, with their accompanying layers of sclerenchyma, form a barrier which the fungal hyphae cannot penetrate. This is obvious in cleared leaf preparations in which the edge of a lesion corresponds with a longitudinal vein. Sometimes there is a slight browning of the mesophyll cells beyond the vein but no

hyphae are ever visible there, and it is probable that the toxic principle diffuses through the vascular strand to some extent.

Restriction of longitudinal spread of the hyphae is difficult to explain. In these three grasses small lateral veins connect the main longitudinal veins, but the laterals usually consist of a single vessel with no accompanying sclerenchyma. It is extremely unlikely that these lateral veins offer any resistance to the spread of the hyphae. Histological examination of the periphery of lesions has revealed no cork formation or other barrier, and it is presumed that some substance is produced which inhibits the further growth of the fungus, though it is clear that the hyphae are not killed, because spores are often produced on lesions which have long since reached their maximum size. The substance may be a product of fungus metabolism analogous to a staling product produced in culture, or may be produced by the plant as a response to attack. It is more likely to be akin to a staling product because the fungi show considerable staling when grown in culture and even under optimum conditions and with a very heavy inoculum, discrete lesions are still produced.

Cunningham (1928) made a histological study of the host-parasite relationships in a number of leaf-spot diseases. In some instances the lesions were delimited by the formation of a layer of cork cells but in most there was no such barrier visible, and he could offer no explanation of the delimitation in these. Dufrenoy (1936) claimed to show that in the development of leaf spots the host cells at first react as if they were susceptible, but in a layer of cells around them, phenolic compounds accumulate which prevent further advance of the fungus. Brown (1936) considered that a more plausible explanation of the arrest of a fungal lesion is the effect of the products of fungal metabolism.

Toxic action of the fungi

Necrosis of the leaf tissue occurs in advance of the hyphae. This implies that some diffusible toxic substance is produced either directly by the fungus or indirectly by the disorganization of leaf tissue.

On the evidence available it seems more likely that the toxic action is due to the production of certain substances by the fungus itself. Efforts were made to obtain cell-free preparations of the toxins which would produce symptoms on the hosts similar to those produced by the fungi themselves, but none of the experiments gave a positive result.

The following extracts were tested for presence of toxin:

(a) Liquid culture media in which the fungi had grown for varying periods of up to two months and from which the hyphae had been removed by Seitz filtration.

(b) Nutrient liquid in which spores had germinated for five to six days and from which the hyphae and spores had been removed.

(c) The dried and powdered young hyphae removed from (b) and extracted in water.

The following methods were used in efforts to detect toxins in these preparations:

(a) The liquid was placed on the undamaged surfaces of leaves.

(b) The liquid was applied to areas of leaf where the epidermis had been scraped away.

(c) The liquid was injected into the mesophyll tissues with a hypodermic needle.

If toxin was present in any of the preparations it would seem unlikely that its presence could not be detected by at least one of these methods. However, the toxin may be either volatile or unstable in the experimental conditions, and it may be that little or no toxin was present in the preparations.

Pectinase enzymes do not appear to be primarily responsible for the formation of the lesions. The fungi grow slowly on the pectin gel described by Rudd Jones (1946) without causing liquefaction. Extracts prepared from dried and powdered young hyphae showed no disintegrating effect on slices of potato tuber, and histological examination of the lesions gave no indication of the dissolution of the middle lamella.

SPECIALIZATION OF PARASITISM

It is characteristic of obligate parasites that their host range is narrow, while that of facultative parasites is considerably wider. The species of *Mastigosporium*, however, belong to a group of facultative parasites with a narrow host range. Each species is capable of parasitizing only a few hosts. Inoculations of each species under varying environmental conditions have never succeeded in producing disease symptoms on inappropriate hosts.* A comparative study was made of the behaviour of *M. album*, *M. rubricosum*, and *M. rubricosum* var. *agrostidis* on grass species which they do not normally attack in the hope that something might be revealed of the nature of specialization of parasitism in these fungi.

Spore germination

It seemed possible that the germination of the spores of a species inoculated on to an inappropriate host might be totally inhibited or so reduced by the liquid on the plant surface as to render the germ tubes incapable of penetration. It is known that substances can diffuse through the cuticle in significant amounts into water on the surface, and Brown (1922) has shown that the resulting solutions may differ in ability to support the germination of fungal spores. These possibilities were tested in two ways:

(a) Naturally formed dew was removed from the host plants in the field and spores were germinated therein. The dew drops were removed from the leaves, using a fine glass capillary tube fitted with a small rubber bulb. The drops were collected in the field in sterilized tubes. Germination tests were set up as soon as the liquid was brought to the laboratory. Table 1 gives the number of germinating spores out of 100 counted after forty-eight hours in each test. Comparative figures for the germination in sterile distilled water are also given.

* By inappropriate hosts are understood those closely related to the normal hosts but in which the fungus either fails to penetrate the tissues or does so only to a limited extent without causing necrosis.

Table 1. *Number of spores germinating after forty-eight hours out of 100 counted, in dew from various plants*

Dew from	Fungus		
	<i>M. album</i>	<i>M. rubricosum</i>	<i>M. rubricosum</i> var. <i>agrostidis</i>
<i>Alopecurus pratensis</i>	9	3	1
<i>Dactylis glomerata</i>	1	6	4
<i>Agrostis stolonifera</i>	4	5	4
<i>A. gigantea</i>	—	—	1
Distilled water	12	35	3

(b) Portions of excised leaves from two of the host plants were placed horizontally on moist sand in Petri dishes. Drops of sterile distilled water were placed on the upper surface of these leaves with a sterile capillary pipette. The moist sand held the leaves in position, thereby preventing the water drops from running off or evaporating. After four days the drops were removed with a sterile pipette and were used as a medium for spore germination. Two hundred spores were counted in each test and Table 2 gives the percentage germination obtained after forty-eight hours. The percentage germination in controls of sterile distilled water is also given.

Table 2. *Percentage germination, after forty-eight hours, of spores germinating in distilled water and water from plant surfaces*

Liquid from	Fungus	
	<i>M. album</i>	<i>M. rubricosum</i>
<i>Alopecurus pratensis</i>	16	28.5
<i>Dactylis glomerata</i>	13	25
Distilled water	26.5	26.5

The amount of germination recorded in Tables 1 and 2 is much lower than that in grass-extract, in which 40 or 60 % of the spores usually germinate. From the above results it can be seen:

(i) The germination of spores of *M. album* is less in the liquids from the leaves than in distilled water.

(ii) The results obtained with the conidia of *M. rubricosum* differ in the two experiments. In dew from the three grass species the germination was much reduced as compared with germination in distilled water. In the other experiment the germination was approximately the same in the control and in the two fluids that had been on the leaf surfaces.

(iii) Germination of *M. rubricosum* var. *agrostidis* was very low in all the liquids.

It is concluded that, although differential germination of the spores of different species of *Mastigosporium* does occur in the liquids from the surface of the different grass species, this effect cannot explain the immunity to attack because some germination occurs in every combination tested.

Histology of attack

To determine the course of development of these fungi in inappropriate host-parasite combinations a histological study of grass leaves inoculated with spores of the different species was carried out with the following combinations:

M. album inoculated on to *Alopecurus agrestis*, *Dactylis glomerata* and *Agrostis stolonifera*.

Mastigosporium rubricosum inoculated on to *Alopecurus pratensis* and *Agrostis stolonifera*.

Mastigosporium rubricosum var. *agrostidis* inoculated on to *Alopecurus pratensis*, *Dactylis glomerata* and *Agrostis gigantea*.

Portions of leaf were fixed twenty-four hours, three, five and seven days after inoculation. The histological procedure has been previously described. The different reactions observed fall into two groups:

(a) In two instances (*Mastigosporium rubricosum* on *Agrostis stolonifera* and *Mastigosporium rubricosum* var. *agrostidis* on *Alopecurus pratensis*) no penetration was observed although the spores germinated readily on the leaf surface. More extensive observations might, of course, reveal some penetration.

(b) In the other six host-fungus combinations germ tubes penetrated into the epidermal cells exactly as on the normal host of each fungus. In one instance (*Mastigosporium album* on *Dactylis glomerata*) the internal hyphae were abnormal: they developed only slightly inside the cell and were thick and twisted. In another combination (*Mastigosporium rubricosum* var. *agrostidis* on *Dactylis glomerata*) more extensive hyphal development occurred and the host epidermal cell seemed to collapse somewhat but without the discoloration typical of normal attack. In the remaining four combinations more or less extensive hyphal development occurred within each infected epidermal cell without causing any apparent adverse effect on the infected epidermal cell itself or the underlying mesophyll cells. The hyphae in the epidermal cells seemed normal. Hyphal development outside the infected epidermal cell was not observed in any of these combinations (Fig. 3).

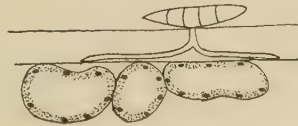


Fig. 3. Camera lucida drawing of longitudinal section of leaf of *Alopecurus agrestis* showing penetration of *Mastigosporium album* into an epidermal cell. Five days after inoculation ($\times 250$).

Ability of grasses to act as substrata for different species of Mastigosporium

For a plant to be able to act as a host for a given parasite, it must be capable of supplying the parasite with essential nutrients and must not contain, in effective concentration, any substance toxic to the parasite. An attempt has been made to determine the ability of the three grasses, *Alopecurus pratensis*, *Dactylis glomerata* and *Agrostis stolonifera*, to support the

growth of species of *Mastigosporium* which do not normally parasitize them.

Two methods of extraction of tissue fluids from the host tissues were used:

(i) *Pressure extracts*. The method used in the present work was very similar to that described by Newton, Brown & Martin (1926). The grass leaves were collected in the field and placed in jars with ice. On being brought to the laboratory the leaves were immediately cut up, wrapped in washed linen cloth and the sap extracted in a Carver hydraulic press at a pressure of 2000 lb. per sq.in. The extracted saps were filtered through a Whatman No. 1 filter-paper on a Buchner funnel to remove plant debris. They were then divided into two portions. One portion was sterilized by passage through a Seitz filter and the other by bringing the pressure up to 1.5 atmospheres in an autoclave. Sterilization by the second method produced a dark green precipitate.

Flasks of $2\frac{1}{4}$ % agar made up with distilled water had been previously sterilized. The agar was now melted and when it had cooled to 50° C. the sterilized saps were added aseptically in the ratio of 50 ml. of sap to 100 ml. of melted agar. The flasks were thoroughly shaken and, while still liquid, the medium was poured into Petri dishes. Thus from each of the three grass species two sterile extracts were produced—one which had been autoclaved and the other which had not been heated above 45–50° C. The first-named extract will be referred to as ‘boiled’ and the other as ‘unboiled’.

(ii) *Dry extracts*. Fresh leaves of each of the three grasses were spread out in glass dishes and dried in an oven at 70° C. for twenty-four hours. The dry leaves were then minced to a fine powder. Each of the powders so obtained was extracted in two ways: (a) 4 g. of powder were extracted in 100 ml. of cold distilled water for ten hours, (b) 4 g. of powder were extracted in 100 ml. of boiling water for two and a half hours.

Each extract was filtered through a Whatman No. 1 filter-paper on a Buchner funnel to remove the plant debris, and each filtrate was then sterilized by Seitz filtration. Flasks of 3 % agar made up with distilled water had been previously sterilized. The agar was now remelted and allowed to cool to approximately 50° C. The Seitz filtrates were thoroughly and aseptically mixed with the melted agar in equal parts and the mixture was poured into Petri dishes while it was still liquid. Thus from each of the three grass species two sterile extracts were prepared, one of which had been heated at 100° C. for two and a half hours and the other which had been heated to 45–50° C. for a short time. As before, the first-named extract will be referred to as ‘boiled’ and the other as ‘unboiled’.

The two methods of extraction (pressure and drying) were standardized to the extent that equal volumes of the final media were derived from equal weights of fresh tissue.

Agrowth rate test was carried out to compare the rates of growth of *Mastigosporium album*, *M. rubricosum* and *M. rubricosum* var. *agrostidis* on each of the twelve types of media. Three plates of each medium were inoculated with each fungus, four inoculations being made on each plate. This gave twelve replications of each of the thirty-six fungus/medium combinations. Measurements of colony diameters were made after fourteen days’ growth. Table 3

gives the average diameter attained by colonies of each fungus on each of the media in this time.

Table 3. Average colony diameters (in mm.) of species of *Mastigosporium* after fourteen days' growth on different extracts of various grasses

Fungus	Growing on extract from	Type of extract	
		Pressure	Dry
A. 'unboiled' extracts			
<i>M. album</i>	<i>Alopecurus pratensis</i>	4.9	7.3
	<i>Dactylis glomerata</i>	5.5	4.4
	<i>Agrostis stolonifera</i>	6.9	5.8
<i>M. rubricosum</i>	<i>Alopecurus pratensis</i>	6.5	9.1
	<i>Dactylis glomerata</i>	8.6	9.6
	<i>Agrostis stolonifera</i>	11.3	8.6
<i>M. rubricosum</i> var. <i>agrostidis</i>	<i>Alopecurus pratensis</i>	9.3	13.3
	<i>Dactylis glomerata</i>	11.9	13.7
	<i>Agrostis stolonifera</i>	11.8	12.2
B. 'boiled' extracts			
<i>M. album</i>	<i>Alopecurus pratensis</i>	7.1	6.6
	<i>Dactylis glomerata</i>	4.8	5.6
	<i>Agrostis stolonifera</i>	4.9	7.9
<i>M. rubricosum</i>	<i>Alopecurus pratensis</i>	6.4	5.5
	<i>Dactylis glomerata</i>	8.2	10.3
	<i>Agrostis stolonifera</i>	10.4	9.9
<i>M. rubricosum</i> var. <i>agrostidis</i>	<i>Alopecurus pratensis</i>	10.9	11.8
	<i>Dactylis glomerata</i>	15.5	10.6
	<i>Agrostis stolonifera</i>	11.5	11.6

Although some of these growth differences are very small, it will be seen that:

(a) Of the four extracts of each host *M. album* grew best on *Alopecurus pratensis* in only two of them. Comparable growth was obtained on all the extracts of *Dactylis glomerata* and *Agrostis stolonifera*.

(b) *Mastigosporium rubricosum* grew best on extracts of *Dactylis glomerata* in only two of the various kinds of extract. In two other instances more substantial growth occurred on *Agrostis stolonifera* extracts.

(c) *Mastigosporium rubricosum* var. *agrostidis* grew better on extracts of *Dactylis glomerata* or *Alopecurus pratensis* than on those from *Agrostis stolonifera*, its normal host.

No methods of extraction can hope to give an extract with a composition comparable to that of the plant tissues. The methods of extraction used in this work are open to the criticism that changes may have taken place in the nature and amount of the plant materials during the extraction process, e.g. changes may well have taken place during the crushing or drying of the tissue or during the heating or Seitz filtration of the extracts. In particular, during these processes substances essential for or toxic to the fungi may be lost or, alternatively, substances may be formed from the breakdown of cell constituents which may act as nutrients or toxins.

Nevertheless the results obtained indicate that any of these three host plants is capable of supporting the growth of any of the three fungi. Differences exist in the ability of any one fungus to grow on extracts of different host species, but the differences do not account for the ability of that fungus to

attack one plant and not others. In some instances a species showed greater growth on extracts of a plant which it will not attack in Nature than on extracts of its usual host.

It is possible that substances which are toxic or inhibitory to the growth of some of these fungi may normally occur in some of these grass species, but they would have to be substances that are destroyed by the different extraction processes used. With this one proviso my results indicate that the specialization of parasitism shown by these fungi cannot be explained on the basis of their inability to grow on the materials available to them in the grasses which they do not attack parasitically.

Discussion of the specialization of parasitism among species of Mastigosporium

The factors responsible for the failure to infect the eight inappropriate fungus-grass combinations examined may now be considered.

(i) Histological examination of *Mastigosporium rubricosum* on *Agrostis stolonifera* and of *Mastigosporium rubricosum* var. *agrostidis* on *Alopecurus pratensis* has revealed no penetration of the fungi into these grasses. The germination of spores of *Mastigosporium rubricosum* in dew from *Agrostis stolonifera* and that of *Mastigosporium rubricosum* var. *agrostidis* in dew from *Alopecurus pratensis* were both reduced as compared with germination in distilled water or in dew from their normal hosts, but enough germination had occurred on the surface of the inoculated leaves to ensure some penetration if this were possible. Nor does mechanical resistance of the cuticle seem to offer an explanation for the lack of penetration, as each grass species is readily penetrated by the other two fungi. The only other suggestion that can be offered is that whatever stimulus in appropriate inoculations causes the germ tubes to grow through the cuticle is ineffective here.

(ii) In each of the other six uncongenial host-fungus combinations penetration of the fungus into an epidermal cell was observed. In no instance was fungal growth ever seen beyond the first infected epidermal cell, though the actual development of hyphae inside the cell varied in the different combinations.

The reasons for the restricted development of hyphae in these instances are obscure. If the young germ tube can penetrate the epidermal cell it does not seem reasonable that the failure of the hyphae to grow beyond the epidermal cell is due to any mechanical inability to do so. The different grasses are able to supply the fungi with the nutrients necessary for further growth, and there appears to be no readily extractable substance in *Alopecurus pratensis*, *Agrostis stolonifera* or *Dactylis glomerata* which might inhibit the growth of species of *Mastigosporium* which do not normally parasitize them.

In only one of these six inappropriate host-fungus combinations were any abnormal-looking hyphae produced inside the host cell. This was accompanied by some change in the contents of the host cell. Inhibition of fungal development here may be due to the production of some toxic substance by the host plant as a result of fungal attack. In the other inappropriate combinations ineffective parasitism may be due to lack of toxin secretion by the fungus sufficient to kill the host protoplasm, or inability of the hyphae to obtain sufficient nutrient.

SUMMARY

Penetration of the appropriate host by species of *Mastigosporium* is achieved by a germ tube growing directly from a spore through the cuticle and outer wall into the cavity of an epidermal cell. The hyphae develop extensively in the epidermal cell and the contents of adjacent mesophyll cells become disorganized. The hyphae grow into the mesophyll, where they cause limited necrosis, but do not extend to the periphery of the affected area.

The lesion is delimited laterally by the sclerenchyma of the parallel leaf veins; longitudinal extension of the lesion is limited, not by a mechanical barrier, but probably by accumulation of staling products.

Efforts to prepare extracts of fungal toxins have been unsuccessful. There is no evidence of the production of pectinase by these fungi.

The specialization of parasitism of these species cannot be accounted for by differential spore germination in liquids on the host surfaces.

Inappropriate grass hosts do not seem to contain any extractable substance which is toxic to the fungi which normally do not parasitize them.

Each fungus can penetrate a number of inappropriate grass species. Hyphal development is restricted to the epidermal cells, and no effect on the mesophyll tissues is apparent. The reasons for non-lethal attack in most of the inappropriate fungus-host combinations studied appear to lie in the inability of the fungi to secrete toxins sufficient to kill the host protoplasm or to derive adequate nutrients from the tissues.

This work was carried out at the Botany School, Cambridge. The writer wishes to express his thanks to Prof. F. T. Brooks for helpful encouragement and criticism.

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CAPE AGARICS AND BOLETI

By A. A. PEARSON

(With Plates 13-19)

The south-west corner of the Cape Province is famous for its flowering plants. Both in the number of species and their striking beauty, few countries can rival this area of South Africa. It is indeed a botanist's paradise.

The fungi, however, have not been fully investigated. The Gastromycetes are well known, and from time to time the Polypores and other resistant fungi have been sent to Europe and America for determination. The more perishable groups have been almost completely neglected, and before these could be effectively studied by resident botanists, the need was felt for a mycologist familiar with the European agarics and boleti to survey the country round Cape Town and report on the species collected. They must be studied *in situ*. Dried specimens are of little value.

I was invited by the University of Cape Town to undertake this task, and went to Cape Town in the autumn of 1948. The present paper gives the list of species collected during the months of April, May and June within a forty-mile radius of Cape Town, and it is hoped later to produce a more detailed account in collaboration with Miss Edith L. Stephens, whose unwearied assistance and genial enthusiasm contributed so largely to the success of the present venture.

It was with considerable misgiving that I agreed to take in hand this much needed investigation. So little is known of the fleshy fungi in the temperate regions south of the equator that it was like taking a journey into unknown regions. A surprising universality exists among the fungi of northern countries. The species recorded for Europe and the non-tropical parts of Asia are practically identical. Even in the warmer climates a large proportion of the same fungi are found. In North America the position is different. The proportion of European species in the north-east has been stated to be about two-thirds. Farther west, the relative proportion changes until it reaches to only about one-third European, but though the species are different, the genera are the same. These specific differences are more or less bound up with the phanerogamic flora, and where the trees, shrubs and herbaceous plants bear little relation to those found in Europe, we may expect the fungi to show marked changes. As is well known, many fungi are found all over the world. These are the species which are not so selective as to host and climate.

The information we have about the more perishable fungi of the southern hemisphere is meagre. Cooke produced, in 1892, a *Handbook of Australian Fungi* which included over 500 agarics and thirty-nine boleti, but this is not a reliable guide as the species had been named from dried material and the notes of correspondents. A more reliable work was published in 1934 on the *Fungi of South Australia* by Prof. J. B. Cleland, and from this we gather that the genera are the same but the proportion of

European species less than a third. Prof. Cleland has recently added to the Australian records of agarics, including several new *Cortinari*. From New Zealand we have very little information and the same may be said of South America.

In South Africa the only serious attempt to deal with the agarics was made by MacOwan who, round about 1880, assiduously collected fungi of all kinds in the Somerset East district in the Eastern Province and sent them to Kew. They were named by Kalchbrenner and Cooke, who published the records in *Grevillea* and described some new species of agarics very inadequately. Some of MacOwan's specimens are in the Herbarium of the Division of Botany at Pretoria; others in the Herbarium of the Cape Town Botanical Gardens to which MacOwan was appointed curator in 1881, but where he was too busy attending to the 'incredible flora of the South-West Cape' to have time for fungi. Some are also in the Kew herbarium but I was unable to identify many of the unfamiliar species we collected with those described in the papers in *Grevillea*. The tradition of the MacOwan species has been completely lost and it is unlikely that more than very few of the names given to the agarics will survive.

The earliest Cape records are those of Berkeley (1843 and 1876) who named a few agarics. There are also some records scattered in various continental journals including two new species of *Lepiota* named by Elias Fries himself in 1849.

In a paper of sixteen pages by P. A. Van der Byl in 1929, entitled 'The Fungous Flora of the Western Province of the Cape', three lines are devoted to the boleti and eighteen to the agarics which had 'received little attention from South African mycologists and our knowledge of the genera and species occurring in the Western Province is scanty and uncertain'. In Nel's list (1942) of Van der Byl's Mycological Herbarium at the University of Stellenbosch, there are only twenty-three South African agarics and four boleti out of about 1400 species.

In view of the extreme richness of South African plant life, I expected to be completely bewildered. In fact the task proved to be much easier than I anticipated. Most of the agarics and all the boleti collected are the same as found in Europe. The reason is simple. The forest trees are for the most part not native but introduced from Europe, Australia and North America. The oak (*Quercus robur*) was extensively planted in the early days of colonisation. In Van Riebeck's journal we read that on 11 October 1656 oak and ash trees were thriving well. The oaks continued to flourish but not the ash trees. By 1687 oaks were producing their own acorns. These old oaks or their successors are seen everywhere but have not been planted much in recent times, their timber not being as good as from the same species in northern climates. They have also suffered badly from attacks of the oak mildew during the last thirty years.

Pine trees were also planted in the early days and especially the stone pine (*Pinus pinea*) which is such a marked feature of Mediterranean scenery. These beautiful trees are also a very striking characteristic of the Cape country but are not much favoured by modern foresters, who are always on the look-out for more commercial types. The cluster pine (*P. pinaster*), also from the south of Europe, grows more quickly and has been widely

planted by the Forestry Department. The Scotch pine (*P. sylvestris*) does not thrive and is almost absent. The favourite forest tree to-day seems to be the Monterey pine from California (*P. radiata*) and they are always experimenting with other conifers.

Of the leafy trees, the grey poplar (*Populus canescens*) is much cultivated, the wood being used for matches. Wattles and gum trees (*Acacia* and *Eucalyptus*) of many different kinds from Australia are also very common—indeed in some parts they have completely altered the landscape. *Eucalyptus* was first introduced in 1828 and is found everywhere in the Cape country.

On the other hand, many of our European trees are almost entirely absent: no beech, birch, elm, ash, larch, spruce or fir, except as occasional garden and arboretum specimens. I mention this because it is the real background to the study of the fungi in the Cape district.

And what about the native trees?

The silver tree (*Leucadendron argenteum*) occurs frequently on the southern and eastern slopes of the Table Mountain range. It belongs to the Protea family, for which South Africa is famous. No fungi were seen under them. Native forests in the area were practically confined to the mountain slopes, and even these had been largely destroyed by fire and axe. Patches are still preserved in the ravines and rather high up on the mountain sides. There seemed to be no fleshy fungi peculiar to the few visited; at least no agarics and boleti.

The large forest formations of indigenous vegetation are about 300 miles to the east in the Knysna and Zitzikama forests, where there are magnificent native trees such as the stinkwood (*Ocotea*) and the yellowwood (*Podocarpus*). It would indeed be worth while visiting these forests at the right time or times of the year.

In the Cape district then, the vegetation which governs the fungus flora is as follows: forest trees introduced from other countries, scattered woods of mixed broad-leaved native trees and a herbaceous and shrubby, very extensive indigenous flora everywhere. The introduced trees brought with them their own associated fungi (*mycorrhiza*). These trees, presumably, could not thrive without them. It is not unlikely that the many trees that failed when transplanted to the soil of South Africa were unsuccessful because their mycorrhiza found the conditions unfavourable, and the roots of the trees without them could not get the nourishment they wanted from the soil, or perhaps the protection they needed during the dry hot summers.

It may reasonably be assumed that the species seen during a single normal season of active collecting within forty miles of Cape Town are fairly representative of the fungus flora of the South-West Cape. Most of the common species will have occurred although, as we know, all common fungi do not fruit every year. There will be a large number of less common and rare species that did not come under our notice. I propose, with one exception, only to record those I myself observed and studied in the autumn and early winter months of 1948. The list contains ten species of *Boletus* and 152 agarics. Of these about three-quarters could be named by a competent mycologist familiar with European fungi. There were a few which originated in Australia.

Most of the others appear to be undescribed species. Some of these may

be the relics of unrecorded or extinct European fungi which have found the South African soil and climate more favourable to survival, but most are probably associated with the native shrubs, herbaceous plants and grasses. At present it is not possible to link them definitely with any special plant. Presumably they derive their sustenance from the humus in the ground which is composed of plant debris. There is, however, no great accumulation of damp half-rotted leaves such as we find in our own woods. The South African climate is against that. Rain, even in the winter, is succeeded by warm sunny days and the leaves shrivel without going through the slow decaying process we know so well.

The grass lands are disappointing. The turf on the veld is thin and there are very few fungi visible. I was always expecting to find troops of small *Mycenae* and *Hygrophori* in the green fields and woods after heavy rain. The only *Mycena* which did appear in vast numbers was *M. rubro-marginata* and that was in the pine woods, flourishing in the same manner and in a similar habitat to what we find in northern Europe. The *Hygrophori* were almost entirely absent; there were none of the gorgeously coloured members of this genus which adorn our own pastures. They do exist, for we found one or two solitary specimens that were too old to identify. The *Cortinari* were also infrequent and those recorded were without the beautiful colours so often associated with this genus. In fact, the South African fungi on the whole are not quite so colourful as our own, though there are some brilliant exceptions.

The total number of species is also small compared with the great diversity found in northern countries. The woods are at times filled with masses of agarics but there was less variety than in our own woods and pastures. For instance, there was a species of *Russula* not found in Europe (*R. capensis*). It has taken possession of nearly all the pine woods and occurs in vast numbers often to the exclusion of other species, except perhaps *R. drimeia*, which holds its own and produces fruit bodies much larger and of more brilliant and varied colouring than in Europe.

This brings me to the question of size. On the whole the South African fungi are much larger than we see in Europe and some are quite astounding in this respect. One of the best instances is the common *Pholiota spectabilis* which sometimes reaches almost giant stature, and then acquires a reddish colour, reminding one at first sight of *Tricholoma rutilans* which did not occur on the pine stumps. The slightly different aspect of some familiar species both in size and colour can be puzzling, and introduces the question whether they should be recorded as new varieties. I have not yielded to this temptation except in a few striking cases.

The fungus flora in the South-West Cape district probably bears little relation to other parts of South Africa. Some of the species may have a wider distribution but most of them are more likely to be confined to this corner of the Cape Province where the vegetation and the seasonal rains are distinct from other areas. Farther north, heavy rains occur in the hot weather after Christmas, and in the more tropical country near the east coast there are other rainy periods. In no other part of South Africa is to be found the same high proportion of introduced trees and that is the most important factor of all.

In the following list the nomenclature is, with a few modifications, that of the 'Revised List of British Agarics and Boleti' by Pearson and Dennis, recently published in these *Transactions*, Vol. xxxi (1948), except of course where the species do not occur in Britain. The classification adopted is admittedly old-fashioned and considerable changes will be called for when the ideas of modern students are more stable. It is felt, however, that the approach to the study of this group of fungi is more easily made on the lines established so effectively by Elias Fries, due weight being given to the characters brought to light by the microscope. Doubtless there will have to be new generic groups based on more detailed methods of diagnosis. Meanwhile on the *festina lente* principle, these new genera, or some of them, are indicated by sectional headings in brackets which later can be adopted if proved to be acceptable.

It has not been possible to illustrate all the new species, but I have been very fortunate in having paintings of some of the more attractive ones made by Miss Mary Maytham, and Miss M. Walgate. These add considerably to the value of this paper.

Type specimens of the newly described species are in the Herbarium, Royal Botanic Gardens, Kew, and specimens have also been deposited at the University of Cape Town. The specimens both at Kew and Cape Town have been given the number indicated at the end of each description in the following pages.

AGARICALES

AMANITA (Pers.) Fr.

- Amanita phalloides* (Vaill.) Fr.
- muscaria* (Linn.) Fr.
- pantherina* (DC.) Fr.
- rubescens* (Pers.) Fr.

LEPIOTA Fr.

- | | |
|---------------------------------------|-----------------------------------|
| (<i>Limacella</i> Earle em. Maire) | <i>Ovisporae</i> Lange |
| <i>Lepiota illinita</i> Fr. | <i>Lepiota cutifracta</i> Pears. |
| <i>guttata</i> (Pers.) Fr. | <i>umbrino-zonata</i> Pears. |
| (<i>Leucocoprinus</i> Pat.) | <i>Amgydalisporae</i> |
| <i>Lepiota zeyheri</i> (Berk.) Pears. | <i>Lepiota fustiformis</i> Pears. |
| <i>naucina</i> Fr. | <i>cristato-cystidiata</i> Pears. |
| <i>Vere-amyloideae</i> | |
| <i>Lepiota praeclara</i> Pears. | <i>Leucobolbitius</i> Lange |
| <i>roseolens</i> Pears. & Stephens | <i>Lepiota truncata</i> Pears. |
| <i>Echinatae</i> Fayod | <i>canescens</i> Pears. |
| <i>Lepiota echinella</i> Quél. | |

ARMILLARIA Fr.

- (*Armillariella* Karst.)
- Armillaria mellea* (Vahl) Fr.

TRICHOLOMA Fr.*Brunneola*

Tricholoma albo-brunneum (Pers.) Fr.
ustale Fr.
meridianum Pears.
eucalypticum Pears.

Fumosa

Tricholoma cinerascens (Bull.) Fr.
(*Melanoleuca* Pat.)
Tricholoma melaleucum (Pers.) Fr.
forma *acystidiatum* Pears.
(*Rhodopaxillus* Maire)

Variecolorata

Tricholoma saponaceum Fr.

Tricholoma panacolum Fr.
truncatum (Schaeff.) Quél.
sublilacinum Cleland

CLITOCYBE Fr.

(*Omphalotus* Fayod)

Clitocybe olearia (DC. ex Fr.) Maire

LACCARIA B. & Br.

Laccaria laccata (Scop.) Fr.

MYCENA Fr.*Calodontes* Fr.

Mycena rubro-marginata Fr.
(= *M. capillaripes* Peck)

Lactipedes Fr.

Mycena sanguinolenta (A. & S.) Fr.

Basipedes Fr.

Mycena tenerrima Berk.

Alcalinae Konr. & Maub.

Mycena alcalina Fr.
ammoniaca Fr.
alcalinoides Pears.
(See also *M. rubro-marginata*)

Rigidipedes Fr.

Mycena galericulata (Scop.) Fr.
vitis Fr. non Rick.

Albidula

Mycena flavo-alba Fr.
gypsea Fr.
hyalina Pears.
vibecina Pears.

Granulatae Lge.

Mycena filopes (Bull.) Fr. non Rick.

COLLYBIA Fr.*Striaepedes* Fr.

Collybia butyracea (Bull.) Fr.
maculatoides Pears.
fragrantissima Pears.

Laevipedes Fr.

Collybia collina (Scop.) Fr.

(Xerula Maire)

Collybia chrysopepla (B. & Curt.) Pears.

Tephrophanae Fr.

Collybia clusilis Fr. (= *pachyphylla* Lge.
non Fr.)

MARASMIUS Fr.*Collybioides*

Marasmius acervatus (Fr.) Pears. & Den.
confluens (Pers.) Karst.

(Androsaceus (Pers.) Pat.)

Marasmius graminum Lib.

OMPHALIA Fr.*Umbelliferae*

Omphalia umbellifera (Linn.) Fr.
var. *flava* Cke.

Graciles

Omphalia gracillima Weinm.

Pyxidatae Fr.

Omphalia pyxidatoides Pears.

PLEUROTUS Fr.

Pleurotus dryinus (Pers.) Fr.

(Acanthocystis Fayod)

Pleurotus atro-caeruleus Fr.

LENTINUS Fr.

Lentinus omphalodes Fr. var. africanus Pears.

SCHIZOPHYLLUM Fr.

Schizophyllum commune Fr.

LACTARIUS Fr.*Glabrati Bat.*

Lactarius deliciosus (Linn.) Fr.

*Lutescenti*Lactarius hepaticus Plowr. (= L. theiogalus
sensu-Rea)**RUSSULA Fr.***Foetentes Konr. & Joss.*

Russula sororia Fr.

*Gratae*Russula grisea (Pers. ex. Secr.) Fr.
xerampelina Fr.
capensis Pears.*Acrae*Russula fallax *sensu* Cke.
drimeia Cke.**VOLVARIA Fr.**

Volvaria speciosa Fr.

media (Schum.) Fr.

PLUTEUS Fr.

Pluteus gracilis (Fr.) Quél.

nanus (Pers.) Fr.

var. lutescens Fr.

*(Rhodophyllum Quél.)***ENTOLOMA Fr.**

Entoloma costatum Fr.

sericeum (Bull.) Fr.

NOLANEA Fr.

Nolanea icterina Fr.

PHOLIOTA Fr.*Eu-Pholiota*

Pholiota pseudo-crebia Pears.

*(Agrocybe Fayod)*Pholiota praecox (Pers.) Fr.
agerita Brig.*(Gymnopilus Karst.)*

Pholiota spectabilis Fr.

(Pholiotina Fayod)

Pholiota parva Pears.

HEBELOMA Fr.*Denudata Fr.*

Hebeloma crustuliniforme (Bull.) Fr.

anthracophilum Maire

angustispermum Pears.

pusillum Lge.

FLAMMULA Fr.

Lubricae Fr.

(*Fulvidula* Romagnesi)

Flammula gummosa (Lasch) Quél.
carbonaria Fr.

Flammula sapinea Fr.
luxurians Pears.
laeti-lamellata Pears.

Subsiccae Lge.

Flammula papillata Pears.

NAUCORIA Fr.

Euagrocyste (Fayod) Heim.

(*Alnicola* Kühner)

Naucoria semi-orbicularis (Bull.) Fr.
vervacti Fr.
arvalis Fr.

Naucoria macrospora Lge.

TUBARIA Gillet

Tubaria furfuracea (Pers.) Gill.

GALERA Fr.

(*Conocybe* Fayod)

Galera tenera (Schaeff.) Fr
siliginea Fr.

CREPIDOTUS Fr.

Crepidotus mollis (Schaeff.) Fr.
var. *calolepis* (Fr.) Pilat
pubescens Bres.

BOLBITIUS Fr.

Bolbitius vitellinus (Pers.) Fr.

CORTINARIUS Fr.

(*Phlegmacium* Fr.)

(*Hydrocyste* Fr.)

Cortinarius brunneo-limosus Pears.

Cortinarius erythrinus Fr.
uraceus Fr.

(*Dermocyste* Fr.)

Cortinarius cinnamomeus Fr.
radio-fibrillosus Pears.

INOCYBE Fr.

Laevisporae

Nodulisporae

Inocybe eutheles B. & Br.

(*Astrosporina* Schroet.)

pallidipes Ell. & Ev.

Inocybe mixtilis (Britz.) Kühner

obscura (Pers.) Fr.

lanuginella (Schroet.) Lange

hirtella Bres.

descissa Fr. var. *brunneo-atra* Heim

congregata Pears.

PAXILLUS Fr.

Paxillus involutus (Batsch.) Fr.
panuoides Fr.

STROPHARIA Fr.

Mundae Fr.

Merdariae Fr.

Stropharia squamosa (Pers.) Fr.
var. *thrausta* Kalch.

Stropharia semi-globata (Batsch) Fr.

HYPHOLOMA Fr.

- (*Nematoloma* Karst.)
Hypholoma fasciculare (Huds.) Fr.
 (*Drosophila* Quél.)
Hypholoma candolleianum Fr.
- (*Lacrimaria* Pat.)
Hypholoma velutinum (Pers.) Fr.

PSILOCYBE Fr.

- (*Drosophila* Quél.)
Psilocybe spadicea Fr.
ammophila Mont.
cylindrispora Pears.
- (*Deconica* W. G. Smith)
Psilocybe coprophila (Bull.) Fr.
 (*Panaeolina* Maire)
Psilocybe foenicisii (Pers.) Fr.

PSATHYRELLA Fr.

- (*Psathyra* (Fr.) Lange. *Drosophila* Quél.)
Psathyrella atomata Fr.
gracilis Fr.
conopilea Fr.
barlae (Bres.) Smith
- (*Pseudo-coprinus* Kühner)
Psathyrella disseminata (Pers.) Fr.
griseola Pears.
praelonga Pears.
Naucorioides
Psathyrella varicosa Pears.

PANAEOLUS Fr.

- Appendiculati*
Panaeolus papilionaceus (Bull.) Fr.
retirugis Fr.
Nudi
Panaeolus sub-balteatus B. & Br.
fimicoloides Pears.
- (*Anellaria* Karst.)
Panaeolus semi-ovatus (Sow. ex Fr.)
 Lundell
forma exannulatus Pears.

PSALLIOTA Fr.

- Flaventes*
Psalliota arvensis (Schaeff.) Fr.
silvicola (Vitt.) Sacc.
xanthoderma Genev.
 var. *lepiotoides* Maire
 var. *meleagrioides* Pears.
comtula Fr.
amethystina Quél.
- Rufescentes*
Psalliota campestris (Linn.) Fr. sensu lato
- Immutabiles*
Psalliota nobilis Pears.
albo-argillascens Pears.
mixta Pears.
 (*Chitonia* Fr. *Clarkeinda* O. Kuntze)
Psalliota volvata Pears.

COPRINUS Fr.

- Peliculosi* Fr.
Coprinus comatus (Fl. Dan.) Fr.
lagopus Fr.
- Farinosi* Lange
Coprinus micaceus (Bull.) Fr.
agricola Pears.
Nudi Lange
Coprinus plicatilis (Curt.) Fr.

BOLETALES

BOLETUS Fr.

Edules Fr.

Boletus edulis (Bull.) Fr.
pinicola Vitt.

(Ixocomus Quél.)

Boletus bellini Inz.
bovinus (Linn.) Fr.
 var. *virido-caerulescens* Pears.
sulphureus Fr.
piperatus (Linn.) Fr.
 (= *B. subflammeus* Berk.)

(Xerocomus Quél.)

Boletus chrysenteron (Bull.) Fr.
badius Fr.
cramesus Secr.

(Krombholzia Karst. or Trachypus Bat.)

Boletus duriusculus Schulz

Among the following descriptions a few well-known European species are included either because the Cape forms are slightly different or the nomenclature somewhat unsettled.

Amanita

The four species in the above list were all common, and the typical *Amanita phalloides* occurred in vast quantities under *Quercus pedunculata* and also under the cork oak *Quercus suber* which forms part of one of the forestry plantations. It is rare to see such quantities of the Death Cup in Europe, and not surprising that there is a wholesome dread of the fungi among the local inhabitants, both white and coloured.

Another form of *Amanita phalloides* occurs in the spring, appearing rather late in August and continuing till the end of October. Miss E. L. Stephens informs me that the colour of the cap is a dirty cartridge buff or chamois with darker centre, sometimes with a tinge of olive buff but never green like the type. This will require further study.

A. pantherina is frequent under oaks, typical in form but rather more greyish in colour than the European type.

A. rubescens was also associated with the oak trees and at times grew luxuriantly.

A. muscaria, which appeared occasionally, did not seem to be confined to any special tree. Its colour was the bright scarlet so familiar to us and not liver-coloured like the common form on the other side of the Atlantic.

Lepiota guttata (Pers. ex Fr.) Quél. = *L. lenticularis* (Laschex Fr.)

Gillet = *Limacella guttata* (Pers. ex Fr.) Konr. & Maubl.

HABITAT: on ground under various trees; fairly common, especially in district near Bergvliet, May-June 1948.

Cap 6-12 cm., with thick flesh, globose then convex slightly viscid especially on margin, pale buff to rosy buff, finally brownish buff, smooth, polished, sometimes rugulose, cuticle thick, peeling to centre, margin

regular or undulate, opaque. *Gills* crowded, ventricose or broadly linear, 7 mm. in large specimens, free, soft, fragile, thin, edge denticulate, many lengths, often forked near stem, white with a slight pinkish tint, later creamy or a candle-grease white when viewed from face. *Stem*. 9–12 cm. long, 3–4 cm. thick, equal or ventricose, often pointed at base, hard, solid, white then dingy brown, silky striate fibrillose, often somewhat shaggy below ring. *Ring* superior pendulous, membranous, single, fragile, white. *Flesh* compact in cap, loose fibrous in stem, horny over gills, white changing to cream with age. *Taste* mild, rancid. *Smell* faint of new meal or cucumber. *Spores* in mass pure white when dropped without gills touching the paper, greyish green when gills have been in contact with the paper; hyaline under microscope, subglobose or broadly ovoid apiculate with granular contents $6-7 \times 5-5\frac{1}{2} \mu$ smooth; no colour reaction to iodine. *Basidia* 4-spored. *Cystidia* absent.

The most striking feature of the Cape form of this species, as described above, is its sturdy robustness. We were unable to observe the dark greenish drop-like markings on the apex of the stem or ring which usually occurs in European specimens and is an effect observable in wet weather.

Lepiota zeyheri (Berk.) Sacc. *Syll.* v, 32 (1887). *Agaricus* (*Lepiota*) *Zeyheri* Berkeley; Hooker's *Lond. Journ. Bot.* II, 507 (1843), Pl. 13

HABITAT: in troops under various trees, in open pastures and by the roadside. Common.

Cap 10–22 cm. or larger, thick fleshy, soft, globose then convex or flat sometimes depressed around the smooth claybrown shallow umbo, elsewhere with large or small concentric white, cream or brown erect or adpressed scales, chalk white underneath, peels to centre, margin regular, smooth, opaque. *Gills* closely crowded, rounded in front, pointed behind, free, remote with rather wide collar, soft, fragile, thin, edge fimbriate, several lengths, white or with a very faint tinge of pinkish buff, then a deeper pink or with pinkish rusty spots; when dried pale tan (Cinnamon Buff: Ridgway). *Stem* 10–20 cm. long, 1–2 cm. thick, cylindric with more or less marginate bulb at base, firm, hollow, white or cream, rusty with handling, smooth or with white fugacious scales above ring, striate *sub lente*. *Ring* membranous, double, two parts distinct with intervening narrow ridge, white, spreading, upper portion fibrillose or shaggy, lower part smooth, white or creamy white, mobile. *Flesh* pure white, unchangeable in very young specimens, turns salmon pink in older ones, loose fibre in centre of stem; cuticle of stem hard. *Taste* mild but rather rancid. *Smell* none or faint and pleasant of mushroom. *Spore powder* pale pink when fresh, pale pinkish buff (Ridgway) later. *Spores* hyaline under microscope, broadly elliptic $15-17 \times 10-12 \mu$, smooth, with germinative pore, contents granular, iodine reaction reddish. *Cystidia*: gill edge sterile with tufted clavate cells of varying size, mostly $30-40 \times 10-12 \mu$. *Cap surface*: septate hyphae $5-7 \mu$ wide. Edible.

Lepiota zeyheri has often been recorded in South Africa, but has been confused with other species. MacOwan identified it with several different species including a *Lepiota* which can now be clearly characterized by its spherical amyloid spores and is fully described below as *L. praeclara*. Dried

specimens of this latter species, collected by MacOwan at Somerset East and labelled *L. zeyheri* No. 1011, were found in the Botanic Museum, Cape Town, and also (unnumbered) at the Herbarium, Royal Botanic Gardens, Kew. At Kew also there is another specimen, No. 1001 which has elliptical truncate spores $10-11 \times 5-6\frac{1}{2} \mu$; this also was sent by MacOwan and wrongly named *L. zeyheri*. A further specimen, labelled in MacOwan's writing *Agaricus (Lepiota) zeyheri*, is in the Herbarium of the Department of Agriculture, Pretoria, and this does appear to be correctly named, though somebody subsequently added *v. elegantula* Sacc.

Fortunately the original specimen on which Berkeley based his description in Hooker's *Lond. Journ. Bot.* II, 507, is at Kew. It was sent by Zeyher from Uitenhage to Berkeley and is labelled Zeyher No. 92. This proves to be the large and striking parasol mushroom common in the Cape Province. Berkeley's description is of course not entirely adequate. The spores are said to be 'tan coloured *in situ*' and that is indeed the colour on the dry gill. When deposited in mass, however, they are, when fresh, pale pink, and in this respect are very like *Lepiota procera* which also has pale pink spore powder, but the spores do not darken the gills when dry in the same way as with *L. zeyheri*.

This handsome agaric was named after Karl Ludwig Philip Zeyher (1799-1858), who was born in Germany and came to the Cape in 1822. He was a good botanist and an assiduous collector of plants which were mainly sent to Kew for determination. Specimen No. 4.

Lepiota naucina Fr. Epicr. (1836) = *L. cretacea* (Fr.) Lundell *Fung. Suec.* No. 502 (1937) = *L. carneifolia* Gillet *Les Hymenocetes* (1874)

HABITAT: solitary, or in troops under various trees or in the open, May-June 1948. Common.

Cap 3-10 cm., fleshy, convex or gibbous then flat with or without umbo, white, tinged brownish grey in patches, peels to centre, smooth, mat, often cracks when old, soft like chamois leather, margin incurved at first, regular, smooth, opaque, remnants of white veil sometimes present. *Gills* crowded, linear or ventricose, wide or narrow, free with a narrow collarium, tender, thin, edge smooth or minutely eroded, unequal, white at first, soon changing to pale pink. *Stem* 6-10 cm. long, 7-10 mm. thick, clavate, swollen at base or more definitely bulbous, firm but hollow, white, brownish with age, silky striate-fibrillose. *Ring* membranous about 3 mm. wide, superior, pendulous or spreading, white, margin, fimbriate. *Flesh* white in cap, horny line over gills; silky white fibrous in stem and sometimes lemon yellow in patches. *Taste* mild. *Smell* faint. *Spores* in mass white or with a very slight pink tinge, almond-shaped or obovate $8-9 \times 5-6 \mu$, 1-guttulate, apiculate, with germinative pore, smooth, iodine reaction rusty red. *Basidia* with 4 sterigmata. *Cystidia* on gill edge sterile, packed with cylindrical thin-walled cells often of irregular outline $9-10 \mu$ wide, easily visible on naked gill but not so clear when examined in liquid. *Cap surface* with closely agglutinated hyphae.

I have retained the epithet *naucina* by which this species is traditionally known in Europe, though there is much doubt as to which name should be

given priority. This is chiefly due to the absence from the original description of *Agaricus* (*Lepiota*) *naucinus* Fr. of any mention of the pink colour of the gills.

***Lepiota praeclara* n.sp. (Pl. 14)**

HABITAT: in rings, sometimes in large numbers; found by the author and Miss E. L. Stephens on grassy ground of paddock at Winford Manor farm near Simonstown, 22 April 1948; by Mrs Cole Rous at Valkenberg football field, 6 May 1949; by Miss Stephens at Rondebosch University football field, 17 May 1949, and on a lawn, April–May 1950.

Cap 5–16 cm., soft fleshy, globose then convex or with shallow depression, at first covered with dense shaggy white wool which slips off at maturity leaving underneath a smooth white silky fibrillose surface, staining to pale lemon, remnants of the woolly veil usually adhering to the centre; cuticle very thick and peeling; margin incurved, regular or plicate, smooth, opaque. **Gills** subdistant, ventricose or linear, 1–2 cm. wide, adnexed then free with narrow collarium, soft, fragile, thin, edge smooth or wavy, unequal, or one length with numerous short ones near margin, white or cream, staining lemon yellow. **Stem** central, easily separable from cap, 7–10 cm. long, 1½–4 cm. thick, equal with round or submarginate bulb at base, hard, white, turning sulphur yellow below ring, woolly-shaggy in early stages, then smooth. **Ring** membranaceous, single, wide, sheathed above and pendulous with torn fimbriate margin. **Flesh** thick, cheesy, white with lemon or sulphur yellow patches. **Taste** mild, nutty but leaving an unpleasant after-taste. **Smell** faint. **Spores** in mass pure white; under microscope hyaline, globose 8–9 μ with apiculus 1–1½ μ long, smooth, with granular contents, amyloid (turning blue in iodine, not red as in many species of *Lepiota*). **Basidia** cylindric-clavate, 40–50 $\times$ 10–12 μ with 4 sterigmata. **Cystidia** none; gill edge fertile. **Specimen No.** 10.

The striking feature of this handsome species is the globose truly amyloid spores which makes its taxonomic position problematical. M. Locquin (*in litt.*) thinks it might be better placed in the *Aspidella* group of *Amanita*, but the symmetrical trama of the gills is not clearly defined, and it bears very little resemblance to other species of this group. For the present it may be considered an aberrant *Lepiota*.

Lepiota praeclara Pearson, sp. nov. In graminosis Simonstown Aprile 1948; Valkenberg et Rondebosch, Maio 1949. **Pileus** 5–16 cm. carnosus, mollis, primo globosus dein convexus; lana alba dense obtectus vel fragmentis ad centrum laxe adhaerentibus; infra laevis, sericeus, fibrillosus, albus demum citrino-tinctus, cute crassissima secernibili; margine regulari vel plicato, laevi, opaco. **Lamellae** subdistantes, ventricosae vel lineares, latae (usque 2 cm.) liberae approximatae, molles, fragiles, tenues, acie laevi, plerumque aequales sed ad marginem pilei breviores, albae vel cremeae, citrino tinctae. **Stipes** 7–10 cm. longus, 3–5 cm. crassus, e pileo facile separabilis, cylindricus, basi bulbo globoso vel submarginato praeditus, durus, albus dein sulfuratus, infra annulum primo laxe floccosus demum laevis. **Annulus** membranaceus, simplex, superus, amplus, pendulus, margine lacerato. **Caro** crassa, alba, maculis citrinis tincta. **Sapor** primo mitis, sed postea ingratus. **Odor** sub-nullus. **Sporae** in cumulo albae, sub microscopo hyalinae, globosae 8–9 μ apiculo 1–1½ μ , laeves, vere amyloideae iode ope caeruleo colorantes. **Basidia** cylindrico-clavata 40–50 $\times$ 10–12 μ tetraspora. **Cystidia** nulla, acie lamellarum fertili.

***Lepiota roseolescens* n.sp. (Pl. 15)**

Collected by Mrs M. Cole-Rous and Miss E. L. Stephens in grassy

football field, forming a large ring twenty-one feet across; Valkenberg, Mowbray, 7 and 9 May 1949, also Rondebosch, April-May 1950.

Cap 10-16 cm., semi-globate, with thick flesh, white to cartridge buff, flushed faintly shell pink (Ridgway), drying to pinkish buff, squarrose all over with woolly scales when young later converging towards the centre; margin incurved at first, wavy and striate when the scaly covering is removed. *Gills* crowded, linear or ventricose, 6-13 mm. broad, free with narrow collarium, somewhat elastic, in several lengths, fairly thick, edge serrate, white at first, soon tinged pink and finally pinkish buff. *Stem* 10-14 cm. long, 1½-3 cm. thick, equal or slightly swollen below, white, tinged pink or when old pinkish buff, thickly covered when young with shaggy pendulous woolly scales and hairs. *Flesh* white, changing to very pale pinkish buff. *Ring* membranous, single, wide, sheathed above and pendulous with torn fimbriate margin, white, flushed pink. *Taste* mild. *Smell* at first sweet, like scented soap, gradually staling as the cap expands and ages, till in the old withering cap it resembles boiling glue. *Spores* in mass white or very faintly tinged pink at first, hyaline under microscope, subglobose apiculate, $9-10 \times 8-9 \mu$, a few larger $11-12 \times 10 \mu$, smooth, contents granular, with or without large guttule, truly amyloid (turning blue in iodine). *Basidia* 4-spored. *Cystidia* absent. Specimen No. 681.

This species is closely allied to *L. praeclara*, described above, from which it differs in many respects. The spore characters of these two species constitute a separate group of *Lepiota* and suggest a near relationship with the *Aspidella* section of *Amanita*.

Lepiota roseolescens Pearson et Stephens, sp. nov. Circulatum in loco graminoso copiose; Valkenberg, Maio 1949. *Pileus* 10-16 cm. semi-globatus, albus vel leviter ochraceus roseolo-tinctus demum roseo-ochraceus, primo squamis lanatis squarrosis omnino obtectus, dein ad centrum adhaerens; margine primo incurvo, undulato, sine squamis striato. *Lamellae* confertae, lineares vel ventricosae, 6-13 mm. latae, liberae postice collario angusto adfixae, sat elasticae, inaequales, modice crassae, acie serrata, primo albae mox roseolescens, tandem roseo-ochraceo tinctae. *Stipes* 10-14 cm. longus, 1½-3 cm. crassus, aequalis vel deorsum leviter incrassatus, albo-roseolus, tandem roseo-ochraceo tinctus, adulescens squamis et fibris pendulis obtectus. *Annulus* membranaceus, simplex, superus, amplus, pendulus, margine lacerato, albus, roseolo-tinctus. *Caro* crassa, alba, sub-roseolescens. *Sapor* mitis. *Odor* primo suavis dein ingratus. *Sporae* in cumulo albae vel primo leviter roseolae, sub microscopo hyalinae, subglobosae apiculatae $9-10 \times 8-9 \mu$, perpaucae majores $11-12 \times 10 \mu$, laeves, saepe uniguttulatae, vere amyloideae, iode ope caeruleo colorantes. *Basidia* tetraspora. *Cystidia* nulla.

***Lepiota cutifracta* n.sp (Pl. 17)**

HABITAT: on ground among grass in troops. Jonkershoek, 31 May 1948.

Cap 2-5 cm., fleshy, shallow convex or gibbous then flat or upturned with or without blunt umbo; reddish cinnamon (cinnamon rufous or vinaceous tawny: Ridgway); cuticle breaking up into irregular adnate patches showing white flesh underneath; mat, granular; margin regular or wavy, smooth, opaque. *Gills* crowded, broadly linear 5-6 cm. wide, free, near stem, soft, thin, edge smooth, white then cream. *Stem* 4-5 cm. long, 3-8 mm. thick, equal, base subbulbous, soft, hollow, white or cinnamon and smooth above, cinnamon squamulose below. *Ring* not well defined, veil subperonate. *Flesh* white in cap, horny brown in stem. *Taste* mild.

Smell pleasant of mushroom. *Spores* in mass white; ovate $5-6 \times 3-3\frac{1}{2} \mu$ smooth, reaction to iodine red. *Basidia* 4-spored. *Cystidia* none. *Cap surface* of loosely compacted septate hyphae $7-12 \mu$ wide. Specimen No. 53.

Lepiota cutifracta Pearson, sp.nov. Gregaria in graminosis. Jonkershoek, Maio 1948. *Pileus* carnosulus, convexus vel gibbosus dein explanato-depressus vel umbonatus, rufo-cinnamoneus, impolitus, cute in squamas adnatas irregulares scissa, carnem albam detegente; margine regulari vel undulato, levi, opaco. *Lamellae* confertae, late lineares, liberae approximatae, molles, tenues, albae dein cremeae, acie laevi. *Stipes* 4-5 cm. longus, 3-8 mm. crassus, aequalis, basi subbulbosa, mollis, fistulosus, sursum albus vel cinnamoneus, laevis, deorsum squamulis cinnamomeis obsitus. *Annulus* vix definitus, velo sub-peronato. *Caro* pilei alba; stipitis corneo-fusca; odore saporeque grato. *Sporae* in cumulo albae, ovatae $5-6 \times 3-3\frac{1}{2} \mu$ laeves, iode ope rubrae. *Cystidia* nulla.

***Lepiota umbrino-zonata* n.sp.**

HABITAT: in troops near compost heap under native shrubs in pine wood. Tokai Forest, 22 May 1948.

Cap 2-6 cm. fleshy, semi-globate then flat or sub-umbonate, silky white with umber brown smooth disk and concentric brown adpressed scales towards margin which is regular or wavy when old, striate. *Gills* subdistant, ventricose, broad (5-10 mm.) free near stem, tender, thin, edge smooth; white. *Stem* 3-7 cm. long, 3-5 mm. thick, clavate, base swollen but not bulbous, soft, hollow, white turning rusty brownish below ring, silky fibrillose striate. *Ring* membranous, single, narrow, white, fugacious. *Flesh* white. *Taste* mild. *Smell* none. *Spores* in mass white; broadly elliptic $9-11 \times 6-7 \mu$ smooth with granular contents; iodine reaction red. *Cystidia* on gill edge cylindric, clavate or flask-shaped $7-8 \mu$ wide. *Cap surface* with brown septate hyphae $3-5 \mu$ wide diameter. Specimen No. 39.

Lepiota umbrino-zonata Pearson, sp.nov. Gregaria sub fruticibus indigenis in pinetis prope herbas putrescentes. Tokai Forest, Autumno 1948. *Pileus* 2-6 cm. carnosulus, semi-hemisphericus demum applanatus vel subumbonatus, albus, sericeus, centro umbrino, levis, alibi squamulis fuscis, adpressis concentricis, ornatus; margine striato regulari vel vetustate undulato. *Lamellae* subdistantes, ventricosae, latae (5-10 mm.) liberae approximatae, teneres, tenues, laeves, albae; acie laevi. *Stipes* 3-7 cm. longus, 3-5 mm. crassus, clavatus basi inflato, mollis, fistulosus, albus dein infra annulum fusco-ferruginosus, sericeus, striato-fibrillosus. *Annulus* membranaceus, simplex, angustus, albus, fugax. *Caro* alba, odore nullo et sapore miti. *Sporae* in cumulo albae, late ellipticae $9-11 \times 6-7 \mu$ laeves, iode ope rubro-tinctae. *Cystidia* in acie lamellorum cylindrica, clavata vel lageniformia apice obtuso $7-8 \mu$ latae. *Cutis pilei* ex hyphis $3-5 \mu$ dia. composita.

***Lepiota fustiformis* n.sp.**

HABITAT: solitary on ground. Tokai Forest, 20 May 1948.

Cap $2\frac{1}{2}$ cm., shallow convex, fleshy, white with ochraceous-brown disk, peels, smooth, matt; margin regular, smooth, opaque, with white remnants of veil at the edge. *Gills* crowded, obovate, narrow, free, remote, soft, thin, greyish white, edge smooth. *Stem* $3\frac{1}{2}$ cm. long, bludgeon-shaped, 5 mm. thick, near apex, much swollen towards base, soft, hollow white, striate innately fibrillose. *Ring* membranous, single, fugacious. *Flesh* white. *Taste* mild. *Smell* none. *Spores* in mass white, amygdaliform $5\frac{1}{2}-7 \times 3-3\frac{1}{2} \mu$ smooth, apiculate, iodine reaction red. *Cystidia* absent. *Cap surface* with septate hyphae about 10μ diameter. Specimen No. 35.

Lepiota fustiformis Pearson, sp. nov. Solitaria ad terram. Tokai Forest, Maio 1948. *Pileus* $2\frac{1}{2}$ cm. carnosulus, convexus, albus, disco ochraceofuscus, laevis, impolitus; cute separabili; margine laevi, opaco, fragmentis veli appendiculato. *Lamellae* confertae, obovatae, angustae, liberae, remotae, molles, tenues, griseo-albae, acie laevi. *Stipes* $3\frac{1}{2}$ cm. longus, sursum 5 mm. deorsum valde incrassatus, mollis, fistulosus, albus, striato-fibrillosus. *Annulus* membranaceus, simplex, fugax. *Caro* alba; sapore grata; odore nullo. *Spores* in cumulo albae, amygdaliformes $5\frac{1}{2}$ – 7×3 – $3\frac{1}{2}$ μ laeves; iodo rubro-tinctae. *Cystidia* nulla. *Cutis pilei* ex hyphis circa 10μ latis composita.

***Lepiota cristato-cystidiata* n.sp.**

HABITAT: solitary on ground under shrubs. Thorpe Farm, near Tokai, Retreat, 18 May 1948.

Cap $1\frac{1}{2}$ – $2\frac{1}{2}$ cm., subfleshy, convex then flat and finally upturned; purplish brown with dark polished centre, elsewhere breaking up into cracks and small scales showing white flesh underneath; margin regular, smooth opaque. *Gills* subdistant, ventricose, 3 mm. wide, free, remote, fragile, thin, edge smooth, white. *Stem* 3–4 cm. long, 3–5 mm. thick, equal, base swollen but not bulbous, soft, hollow, silky fibrillose striate, white. *Ring* membranous, single, white, fugacious. *Flesh* white in cap; hyaline white in stem. *Taste* mild. *Smell* rather unpleasant. *Spores* in mass white; pip-shaped or subamygdaliform 1 – 2 guttulate, 7 – $8 \times 4\frac{1}{2}$ – 5μ smooth, iodine reaction red. *Cystidia* on sterile gill edge crowded, cylindric or sack-shaped with cristulate apex 25 – 30×10 – 12μ , walls rather thin. *Cap surface* septate hyphae 7 – 18μ wide. Specimen No. 33.

Lepiota cristato-cystidiata Pearson, sp. nov. Solitaria ad terram sub arbustis Retreat, Maio 1948. *Pileus* $1\frac{1}{2}$ – $2\frac{1}{2}$ cm. carnosulus, e convexo planus, denique revolutus, purpureo-fuscus, centro obscuriore et polito, aliter in rimas et squamulas scindens, carnem albam detegens; margine regulari, laevi, opaco. *Lamellae* subdistantes, ventricosae, 3 mm. latae, liberae, remotae, fragiles, tenues, albae; acie levi. *Stipes* 3–4 cm. longus, 3–5 mm. crassus, teres, basi incrassatus, mollis, fistulosus, sericeus, fibrilloso-striatus, albus. *Annulus* membranaceus, simplex, albus, fugax. *Caro* pilei alba, stipitis hyalino-alba; sapore miti, odore sub-nauseoso. *Spores* in cumulo albae, ellipticae apiculatae vel sub-amygdaliae 1 – 2 guttulae 7 – $8 \times 4\frac{1}{2}$ – 5μ laeves; iode ope rubrae. *Cystidia* copiosa in aciem lamellarum cylindrica vel sacciformia apice muricellata 25 – 30×10 – 12μ . *Cutis pilei* ex hyphis 7 – 18μ latis consistens.

***Lepiota truncata* n.sp (Pl. 16)**

HABITAT: in troops on ground near various trees and shrubs, sometimes on burnt ground. Common, April–June 1948.

Cap 1–6 cm., rather fleshy, at first almost cylindrical with flat top (inverted bucket-shaped) then campanulate usually with persistent truncate disk, white at first with smoky brown centre breaking into concentric recurved scales, white then brownish buff, easily rubbing off showing silky white fibrillose surface underneath; margin striate when old often with appendiculate veil. *Gills* very crowded, free, near stem, ventricose, pointed both ends, 3–5 mm. wide, of several lengths, thin, edge fimbriate, white soon staining lemon yellow in patches. *Stem* 5–6 cm. long, 3–5 mm. thick, separable from cap, equal or attenuated above, solid then hollow, smooth or flexuose, white or pinkish, silky fibrillose, covered with white pruina when fresh. *Ring* membranous 2–3 mm. wide, patent, mobile, white with buff fimbriate edge, sometimes adhering in fragments to margin of cap. *Flesh* white, unchangeable. *Taste* mild. *Smell* none. *Spores* in mass white,

under microscope hyaline almond-shaped, 1-2 guttulate, $10-12 \times 5-6 \mu$ smooth, red in iodine, germinative pore visible. *Cystidia* abundant on gill edge, sack- or gourd-shaped $12-20 \mu$ wide, thin-walled often with a secondary bulge and long filiform appendage. *Cap surface* of loose texture, rather thick-walled hyphae $16-25 \mu$ diameter. Specimen No. 6.

Lepiota truncata Pearson, sp. nov. Gregaria ad terram variis locis prope diversas arbores etiam ad terram adustam. Frequens. Aprile-Maio 1948. *Pileus* 1-6 cm. carnosulus, primo sub-cylindricus apice plano, demum campanulatus plerumque centro valde truncato, albus, disco fusco, cute in squamulas albas dein fuscas recurvatas concentricae scissa, carnem sericeam, albam, fibrillosam detegente; margine vetustate striato, saepe velo appendiculato. *Lamellae* confertissimae, ventricosae, utrinque attenuatae, 3-5 mm. latae, liberae approximatae tenues, albae mox hinc inde gilvescentes, acie fimbriata. *Stipes* 5-6 cm. longus, 3-5 mm. crassus, facile separabilis, aequalis vel sursum attenuatus, deorsum saepe inflatus, laevis vel flexuosus, albus vel roseolus, sericeus, fibrillosus, pruinosis. *Annulus* membranaceus, patens, mobilis, albus, margine luteolo fimbriato fragmentis saepe ad pileum adhaerentibus. *Caro* alba; odore et sapore gratis. *Sporae* in cumulo albae, amygdaliformes $10-12 \times 5-6 \mu$ laeves 1-2 guttulae, poro germinativo visibili, iode ope rubrae. *Cystidia* in aciem lamellarum numerosa cucurbitiformia $12-20 \mu$ lata, saepe apice filiforme-appendiculata.

***Lepiota canescens* n.sp. (Pl. 16)**

HABITAT: on bare soil or grass near native shrubs; in groups of two or three. Kirstenbosch, 24 April 1948.

Cap 2-8 cm., fleshy in centre, soft, globose then campanulate, finally flat with depressed disk, white, disk brown-buff and smooth, elsewhere with small brown (café au lait) concentric scales, silky, fibrillose; margin eroded, smooth at first but striate in larger specimens when old. *Gills* very crowded, lanceolate, pointed both ends, narrow 3-4 mm. wide, free, remote, soft, fragile, thin, edge fimbriate; white, lemon colour when rubbed, pinkish grey when old. *Stem* 6-10 cm. long, 3-5 mm. thick, clavate, swollen but not bulbous at base, soft, hollow, white above, tinted flesh pink below. *Ring* membranous, single, spreading, white with brownish edge 2-3 mm. wide, mobile but fugacious and often absent. *Flesh* white in cap, flesh pink with white fibrous stuffing in stem. *Taste* mild. *Smell* pleasant of mushroom. *Spores* in mass white; elliptical or obovate $9-11 \times 6-7 \mu$, 1 guttulate, smooth, germ pore visible; iodine reaction red. *Cystidia* gill edge sterile with tufts of pyriform cells $10-14 \mu$ wide. Specimen No. 15.

Lepiota canescens Pearson, sp. nov. Gregatim ad terram nudam et in graminosis prope frutices indigenos. Kirstenbosch, Aprile 1948. *Pileus* 2-8 cm. centro carnosulus, globatus dein campanulatus demum planodepressus, albus, disco fusco-umbrino et laevi, aliter squamulis concentricis umbrinis ornatus, sericeus, fibrillosus; margine eroso, primitus laevi sed vetustate striato. *Lamellae* confertissimae, lanceolatae, utrinque acutae, angustae, liberae, remotae, molles, fragiles, tenues citrinae denique roseolocanescentes. *Stipes* 6-10 cm. longus, 3-5 mm. crassus, basi incrassatus, mollis, fistulosus, sursum albus, infra carneotinctus. *Annulus* membranaceus, simplex, patens, albus, margine fusco 2-3 mm. latus, mobilis sed fugax, saepe deficiens. *Caro* pilei alba, stipitis incarnata intus fibris laxis albis farcta. *Sapor* mitis. *Odor* gratus funginus. *Sporae* in cumulo albae, ellipticae vel obovatae $9-11 \times 6-7 \mu$ 1 guttulae laeves, poro germinativo visibili; iode ope rubrae. *Cystidia* clavata-pyriformia $10-14 \mu$ latae.

***Tricholoma meridianum* n.sp.**

HABITAT: on ground in wood of *Pinus pinea* beside Bottelary Road, near Stellenbosch and elsewhere, May-July 1948. In troops.

Cap fleshy, 7-15 cm. convex, reddish brown, often blackish in centre and

with dark spots near margin, sometimes ridged (abruptly turned down) at margin, viscid, peeling, smooth, polished when dry, margin incurved at first, regular or wavy, smooth, opaque, sometimes sulcate at extreme edge. *Gills* crowded or subdistant, ventricose or linear, broad, unequal, adnexed deeply emarginate with decurrent tooth, rather thick, white with reddish spots, edge smooth. *Stem* central 5–12 cm. long, 2–3 cm. thick, equal or ventricose, base more or less attenuated, hard, solid, white above and with thin membranous peronate closely adnate reddish brown ring $\frac{2}{3}$ or $\frac{3}{4}$ up stem. *Flesh* white, unchangeable or turning reddish brown in parts. *Taste* mild. *Smell* none. *Spores* in mass white, broadly ovoid apiculate, $5\frac{1}{2}-6 \times 4-4\frac{1}{2} \mu$ smooth, with large guttule, non amyloid. *Cystidia* absent. *Cap surface* with septate hyphae 6–7 μ diameter.

It is with some hesitation that a new name has been given to this robust species which belongs to the large group of *Tricholomas* with viscid pileus, that centre round *T. albo-brunneum*, but cannot be fitted into any of those hitherto described. It is nearest to *T. subannulatum* Bres. non Batsch which, however, has bitter flesh. In colour it also suggests *T. robustum* (*Armillaria robusta*), but the peronate ring is tenuous and the pileus viscid. Specimen No. 77.

Tricholoma meridianum Pearson, sp.nov. Gregaria ad terram sub pinetis (*Pinus pinea*) prope Stellenbosch et alibi, Junio 1948. *Pileus* carnosus 7–15 cm. convexus, rufo-brunneus, prope marginem maculis obscuris ornatus et interdum abrupte inflexus, viscidus, cute secernibili, glaber, sicco politus, margine primo incurvato, regulari vel undato, glabro, opaco, aliquando sulcato. *Lamellae* confertae v. subdistantes, ventricosae v. lineares, latae, inaequales, adnexae, profunde emarginatae dente decurrenti, crassulae, albae punctis rufis maculatae, acie glabra. *Stipes* centralis, 5–8 cm. longus, 2–3 cm. crassus, aequalis vel ventricosus basi plus minusve attenuatus, durus, solidus, sursum albus, deorsum annulo peronato membranaceo tenuo adpresso rufo-brunneo praeditus. *Caro* alba immutabilis vel hinc inde maculata. *Sapor* dulcis. *Odor* nullus. *Sporae* in massa albae, late ovoideae apiculatae $5\frac{1}{2}-6 \times 4-4\frac{1}{2} \mu$ laeves, guttula magna praedita, non amyloideae. *Cystidia* nulla. *Cutis pilei* ex hyphis 6–7 μ latis composita.

Tricholoma eucalypticum n.sp. = *T. coarctatum* Cleland, non Cke. & Mass in *Toadstools and Mushrooms of South Australia*, Pt. 1, p. 63 (1934).

HABITAT: in troops, often tufted in sandy ground under or near gum trees (*Eucalyptus* sp.). Ida's Valley, Stellenbosch, 30 May 1948; Malmesbury District, 26 June 1948.

Cap 4–10 cm., thick, fleshy, convex then flat or depressed, white soon changing to flesh pink usually in patches and finally brownish buff, slightly viscid soon dry, peels to centre, smooth, mat; margin incurved at first, regular or wavy, smooth, opaque. *Gills* crowded or subdistant; linear ventricose or arcuate, 5–7 mm. wide, adnexed or adnate emarginate or subdecurrent, somewhat elastic, thin, edge smooth, white or with slight creamy tint in contrast to chalky white flesh. *Stem* central or sometimes excentric, 4–8 cm. long, 2–5 cm. thick, usually obconic acuminate, very robust and hard, white, spotting dirty pink, minutely squamulose. *Flesh* very thick and firm, chalk white, unchangeable. *Taste* mild, rather rancid with unpleasant after taste. *Smell* of new meal. *Spores* in mass white; broadly pip-shaped or subglobose, $4\frac{1}{2}-5\frac{1}{2} \times 3\frac{1}{2}-4 \mu$, smooth with one large guttule rendering outline of spore barely visible. Non-amyloid. *Cystidia* none.

Cleland based his record for *T. coarctatum* on the description given in Cooke's *Handbook of Australian Fungi*, but the type specimen at Kew proved to be different. Cooke's original drawings also show a rather small agaric which can hardly be identified with the large robust species described above. *T. eucalypticum* appears to be widely spread in Australia and will probably prove to be common in South Africa where gums are planted. It can easily be overlooked as it does not push itself far out of the ground, often showing only the top of the cap which is much the same colour as the sandy soil. Specimen No. 78.

Tricholoma eucalypticum Pearson, sp. nov. = *T. coarctata* Cleland non Cke & Mass. Gregaria, saepe caespitosa ad terram arenosam sub Eucalyptis; in regione capense, Maio et Junio 1948. *Pileus* 4–10 cm. carnosus, e convexo plano-depressus, albus, mox in maculas sordide rubescens et tandem brunneolus, viscidulus mox siccus, cute secernibili, laevis, impolitus; margine primitus incurvo, regulari vel undulato, opaco. *Lamellae* confertae vel subdistantes; lineares, ventricosae v. arcuatae, 5–7 mm. latae, adnexae emarginatae vel sub-decurrentes, tenues, albiae vel pallide cremeae; acie laevi. *Stipes* centralis, interdum excentricus, 4–8 cm. longus, 2–5 cm. crassus, plerumque obconico-acuminatus, robustissimus, albus, roseolens et brunnescens, minute squamulosus. *Caro* spissa et firma, cretaceo-alba, immutabilis. *Sapor* mitis sed tandem nauseosus. *Odor* farinaceus. *Sporae* in pulvere albae; late obovatae apiculatae, crasse 1-guttatae $4\frac{1}{2}$ – $5\frac{1}{2} \times 3\frac{1}{2}$ – 4μ non amyloideae. *Cystidia* nulla.

***Tricholoma melaleucum* (Pers.) Fr. forma *acystidiatum* n.f.**

HABITAT: gregarious in field, south of Philadelphia, C.P., 26 June 1948.

Cap fleshy, 2–7 cm. flat or depressed, often with a central pointed papilla, smoky grey with brown tint, darker in centre, smooth, mat; margin incurved at first, regular, opaque. *Gills* crowded, ventricose, rather broad (5–6 mm.), unequal, adnate emarginate, fragile, thin, white at first, rather greyish later, edge smooth. *Stem* central, 3–4 cm. long, 5–6 mm. thick equal but swollen at base, firm, solid, white with black striate fibrils. *Flesh* dingy white, with horny line over gills. *Taste* mild, rather rancid. *Smell* none or faint. *Spores* in mass white, broadly elliptical, 8 – $10 \times 5\frac{1}{2}$ – 6μ echinulate, amyloid. *Basidia* 4-spored. *Cystidia* absent, gill edge fertile. *Cap surface* with loosely woven hyphae mostly 10–12 μ diameter. Specimen No. 80.

T. melaleucum (Pers.) Fr. (= *Melanoleucum vulgare* Pat.) is a common species in Europe. It has been described under many different names, some of which have been revived in recent years for species chiefly differentiated by the size and shape of the cystidia which are variable and may indeed vary in the same specimen. Normally these cystidia are lanceolate and the apex is crested with lime crystals. In a few rare cases they appear to be absent, and two non-cystidiate forms have been described as separate species by George Metrod in *Revue de Mycologie* vii, 93–4 (1942). We do not know if the absence of cystidia is a constant character. It is enough to record the above form with a view to its further investigation later.

***Tricholoma sublilacinum* Cleland in *Toadstools and Mushrooms of South Australia*, Pt. I, p. 64 (1934)**

HABITAT: in troop on ground under *Pinus pinaster*, Papegaaisberg, 29 May 1948.

Cap fleshy, 3–7 cm., shallow convex then flat or upturned, smoky grey

or lilaceous drab, dry, smooth, innately fibrillose, polished; margin incurved regular or wavy, smooth, opaque. *Gills* crowded, easily separable from cap, linear, wedge-shaped or arcuate, 5–10 mm. broad, unequal, adnate emarginate, fragile, thin, smoky grey or bluish lilac, edge smooth often wavy. *Stem* 3–5 cm. long, 6–10 mm. thick, equal, soft, hollow, fibrillosely striate often rugulose, base with white tomentum, grey with dark streaks or bluish tint. *Flesh* white or dingy white. *Taste* mild. *Smell* pleasant, rather fragrant. *Spores* in mass sea-shell pink (Ridgway), under microscope creamy hyaline ellipsoid, $5-6 \times 3\frac{1}{2} \mu$ smooth, non-amyloid. *Cystidia* none.

This species clearly belongs to the section *Rhodopaxillus* and would be placed next to *Tricholoma sordidum*. The colours are very variable, the bluish tinge sometimes being present in all parts but hardly visible at all in many specimens. In most species of *Rhodopaxillus* the spores are slightly rough or warted, but even when highly magnified and with oil immersion, I could not see any roughness in the spores of *Tricholoma sublilacinum*. Specimen No. 47.

***Mycena alcalinoides* n.sp.**

HABITAT: in tufts on rotten stump and also on living oak tree. Rondebosch and Claremont Park, June 1948.

Cap $1\frac{1}{2}$ – $2\frac{1}{2}$ cm., subfleshy, conical or semi-globate, blackish brown or dingy greyish brown, smooth, innately radiately fibrillose. *Gills* subdistant, ventricose, rather wide (3 mm.), adnate emarginate, thin, white, edge smooth. *Stem* 3–4 cm. long, 2 mm. thick, even, elastic, striate, white above, brown below. *Flesh* white. *Taste* mild. *Smell* faint of soap extracts. *Spores* in mass white; ovoid $8-10 \times 6-7 \mu$, smooth, 1 guttulate, amyloid. *Cystidia* on gill edge lanceolate, acute, $16-25 \times 10-12 \mu$ thin walled. *Cap surface* with narrow hyaline hyphae mixed with some wider and shorter blackish ones, 20–30 μ diameter. Specimen No. 70.

Differs from *M. alcalina* in the larger spores, smaller cystidia and the different smell.

Mycena alcalinoides Pearson, sp.nov. Caespitosa ad truncos quercinos. Rondebosch, Junio 1948. *Pileus* $1\frac{1}{2}$ – $2\frac{1}{2}$ cm. carnosulus, conicus vel semi-globosus, brunneo-nigrus vel sordide griseo-brunneus, laevis, subtiliter radiato-fibrillosus. *Lamellae* subdistantes, ventricosae, latae (circa 3 mm.) inaequales, adnato-emarginatae, tenues; acie laevi. *Stipes* 3–4 cm. longus, circa 2 mm. crassus, teres, elasticus, striatus. *Caro* alba. *Sapor* mitis. *Odor* leviter alcalinus. *Sporae* in cumulo albae; ovoideae $8-10 \times 6-7 \mu$ 1 guttulate, laeves; amyloideae. *Cystidia* in acie lamellarum lanceolata acuta $16-25 \times 10-12 \mu$.

***Mycena hyalina* n.sp.**

HABITAT: gregarious on ground near native shrubs in wood of *Pinus radiata*. Cecilia plantation, April 1948.

Cap 1–2 cm., membranous, convex then flat with depressed centre, hyaline white with slight yellow tint when old, silky, striate-sulcate to disk, translucent, smooth. *Gills* distant, narrow linear or ventricose (about 2 mm.) one length only, deeply emarginate with decurrent tooth, not very fragile or brittle, thickly veined on face and at base (veins sometimes absent), thin, smooth, white edge acute, smooth. *Stem* 3–4 cm. long, 1–2 mm. thick, equal or slightly swollen at apex, stiff, brittle, white, polished, smooth, naked. *Flesh* very thin, white. *Taste* pleasantly acid. *Smell* none. *Spores*

in mass white; globose apiculate $6-7\frac{1}{2}\mu$ smooth, amyloid. *Basidia* with 2 sterigmata. *Cystidia* absent. Specimen No. 7.

No cystidia were observed. This is unusual for a *Mycena*, but I cannot see that it can be placed in another genus. The question does arise whether it should be connected with the group of porolamellose agarics which have been investigated by several modern authors (Kühner, Heim and Singer), and placed in various new genera. The thick anastomosing veins on the gills in *Mycena hyalina* are very remarkable and were present in most specimens but not in all.

Mycena hyalina Pearson, sp.nov. Gregaria ad terram prope frutices indigenos in pinetis (*Pinus radiata*). Aprile 1948. *Pileus* 1-2 cm. membranaceus, ex convexo plano-depressus hyalino-albus, laevis, dilute luteotinctus, striato-sulcatus usque ad discum. *Lamellae* distantes, lineares vel ventricosae, angustae (circa 2 mm.) tenues, aequales, adnato-emarginatae denti decurrenti, sub-elasticae, valde venosae (interdum absque venis), albae; acie acuta laevi. *Stipes* 3-4 cm. longus, 1-2 mm. crassus, aequalis vel apice subinflatus, rigidus, fragilis, albus, politus, laevis, nudus. *Caro* pilei tenuissima, alba. *Sapor* grate acidulus. *Odor* sub-nullus. *Sporae* in cumulo albae; globosae apiculatae $6-7\frac{1}{2}\mu$. laeves, amyloideae. *Basidia* 2-sterigmatica. *Cystidia* nulla.

***Mycena vibecina* n.sp.**

HABITAT: gregarious on ground in pine woods, University, Rondebosch and Cecilia Plantation, April-June 1948.

Cap 7-25 mm., membranaceous, convex then flat or upturned, often with small umbel, grey or white with grey striae to centre, smooth; margin incurved at first. *Gills* subdistant or distant, wedge-shaped, adnato-decurrent, fragile, white, rather thick with blunt edge, sometimes veined at base. *Stem* 2-4 cm. long, about 1 mm. thick, equal or inflated at apex, firm and elastic, smooth, polished, white and pruinose above, grey or dingy brown below. *Flesh* white. *Taste* mild. *Smell* farinaceous. *Spores* in mass white; ovoid apiculate $6-8 \times 4\frac{1}{2}-5\mu$ smooth, amyloid. *Cystidia* on gill edge long filiform $4-5\mu$ diameter. Specimen No. 22.

Mycena vibecina Pearson, sp.nov. Gregaria ad terram in pinetis. Rondebosch, Autumn 1948. *Pileus* 7-25 mm. membranaceus e convexo planus, leviter umbilicatus vel sub-infundibuliformis, griseus vel albidus, a margine ad centrum griseo-striatus, laevis; margine primitus incurvo. *Lamellae* subdistantes vel distantes, cuneiformes adnato-decurrentes, fragiles, albae, in fundo interdum venoso-conjunctae; acie obtusa. *Stipes* 2-4 cm. longus, circa 1 mm. crassus, aequalis vel supra inflatus, firmus et elasticus, laevis, politus, sursum albus et pruinosis, deorsum griseus vel fuscus. *Caro* alba. *Sapor* mitis. *Odor* farinaceus. *Sporae* in cumulo albae; ovoideae apiculatae, $6-8 \times 4\frac{1}{2}-5\mu$ laeves, amyloideae. *Cystidia* in acie lamellarum longa, filiformia, $4-5\mu$ diametro.

***Collybia maculatoides* n.sp.**

HABITAT: on ground in troops at base of stump in plantation of *Populus canescens*; Ida's Valley, Stellenbosch, 30 May 1948.

Cap 4-6 cm., fleshy, shallow convex or depressed, plicate in large specimens, dingy white, smoky in centre, peels, smooth, mat, margin incurved at first, regular or wavy, smooth, opaque; rather fragile. *Gills* subdistant; linear, ventricose or arcuate, adnexed with decurrent tooth, elastic, thin, edge smooth, several lengths, creamy white. *Stem* central or slightly excentric 6-8 cm. long, 4-8 mm. thick attenuated downwards, solid, cartilaginous, white or with slight brown flush, innately fibrillose, striate. *Flesh* white. *Taste* mild. *Smell* none. *Spores* in mass white; globose $5-6\mu$

with large guttule, apiculus barely visible; non amyloid. *Cystidia* absent. *Cap surface* with septate hyphae about 7μ wide.

Closely related to *Collybia maculata* from which it differs in several features, especially in the colour of cap and stem, and in the spacing of gills. Specimen No. 50.

Collybia maculatoides Pearson, sp.nov. Ad terram gregatim prope basim truncorum in locis arboribus consitis (*Populi canescentis*). Stellenbosch, Autumno 1948. *Pileus* 4-6 cm. carnosus modice fragilis e convexo planodepressus, pallide griseus vel sordide albus, in centro fumosus, laevis, impolitus, cute separabili; margine primitus incurvato, regulari vel undulato, laevi, opaco, interdum plicato. *Lamellae* subdistantes; lineares, ventricosae vel arcuatae, adnexae dente decurrente, 5-10 mm. latae, inaequales, elasticae, tenues, cremeae, acie laevi. *Stipes* centralis vel modice excentricus 6-8 cm. longus, 5-12 mm. crassus, sursum dilatatus, solidus, cartilagineus, albus vel leviter brunneo tinctus, striatus, innatofibrillosus. *Caro* alba; inodora et insapora. *Sporae* in cumulo albae; globosae apiculo vix visibili, 5-6 μ i guttulae, laeves. *Cystidia* nulla, acie lamellarum fertili. *Cutis pilei* ex hyphis circa 7μ latis composita.

Collybia fragrantissima n.sp.

HABITAT: in troops on ground among grass under stone pine (*Pinus pinea*); Bergvliet, Retreat, 26 May and 3 June 1948, and at Simonstown, 20 June 1948.

Cap 1-5 cm., fleshy, shallow convex then flat or upturned, smoky grey then white often with a smoky disk smooth, mat, peels to centre; margin incurved when young, regular or wavy, smooth, opaque. *Gills* crowded, linear, narrow, adnate, soft, thin, edge smooth, several lengths, pale grey becoming darker when old. *Stem* 3-6 cm. long, 4-5 mm. thick, even or thicker at apex, base more or less bulbous, somewhat elastic, hollow, white, greyish when handled, white tomentum at base, striate-fibrillose. *Flesh* white. *Taste* mild. *Smell* strong and fragrant; difficult to define: rather like heliotrope or between heliotrope and aniseed. *Spores* in mass white, under microscope hyaline elliptical $5-6 \times 3-3\frac{1}{2}\mu$ smooth, non-amyloid. *Basidia* 4-spored. *Cystidia* absent. *Cap surface* with closely agglutinated hyphae about 3-4 μ diameter.

An all white form was also found in open ground at the Cape Point Reserve growing in distorted tufts, 20 June 1948. Specimen No. 43.

Collybia fragrantissima Pearson, sp.nov. Dense gregaria inter graminis, sub *Pineo pinea*; etiam solitaria vel caespitose in locis apertis. Maio 1948. *Pileus* 1-5 cm. carnosus, e convexo planus vel depressus, sub arboribus fumoso-griseus dein albus saepe centro fumoso; in locis apertis albus, laevis, impolitus; margine primo incurvato, regulari vel undulato, laevi, opaco. *Lamellae* confertae, lineares, angustae, adnate, molles, tenues, inaequales, pallide griseae, vetustate obscuriores; acie laevi. *Stipes* 3-6 cm. longus, 4-5 mm. crassus, aequalis vel supra incrassatus, basi bulboso, sub-elasticus, cavus, striato-fibrillosus, albus, tactu cinerascens, ad basim tomento albo praeditus. *Caro* alba. *Sapor* mitis. *Odor* fortiter fragrans, inter heliotropium et anisum. *Sporae* in cumulo albae; ellipticae $5-6 \times 3-3\frac{1}{2}\mu$ laeves, non amyloideae. *Basidia* tetraspora. *Cystidia* nulla. *Cutis pilei* ex hyphis dense agglutinatis 3-4 μ latis composita.

Collybia chrysoplepla (B. & Curt.) n.comb. (Pl. 17)

Lentinus chrysopleplus Berk. & Curt., *Linn. Soc.* x, 301 (1868).

Agaricus (*Tricholoma*) *lacunosus* Peck, *Rep.* no. 26, p. 51 (1873).

Collybia lacunosa (Peck) Peck, *Rep.* no. 44, p. 176.

Agaricus (*Pleurotus*) *aureo-tomentosus* Kalch. *Grev.* ix, 17 (1880).

Clitocybe verruculosa De Seynes, *Champ. Cong. Fr.* (1897).

Marasmius aculeatus Pat. *Bull. S.M. Fr.* no. 16, 175 (1901).

Gymnopus chrysopheplus (B. & C.) Murrill, *N.Am. Fl.* no. 9 (1916).

Xerula chrysophepla (B. & C.) Singer, *Mycologia* no. 35, 156 (1943).

HABITAT: on sticks and fallen branches in damp wood of *Populus canescens* mixed with other vegetation, Jonkershoek, 31 May 1948.

Cap 1–3 cm., subglobose then flat, fleshy, dry, densely covered with brilliant orange spines which rub off leaving a pure white surface beneath, with striate-sulcate margin, incurved at first; woolly white veil sometimes appendiculate. *Gills* distant, ventricose or linear 2–3 mm. broad, two lengths, adnate or subdecurrent, tender, thin, edge smooth. *Stem* central 1–3 cm. long, 2–4 mm. thick, equal or with base slightly swollen, cartilaginous, at first orange or lemon coloured at apex, woolly fibrillose with fugacious orange scales or spines at base, afterwards smooth and white. *Flesh* hyaline white. *Taste* mild. *Smell* none. *Spores* in mass white, subglobose to very broadly lemon-shaped, $6-7\frac{1}{2}(10) \times 5-7\mu$, smooth, with granular contents, iodine reaction nil. *Basidia* 30–40 $\times$ 5–6 μ with 4 sterigmata. *Cystidia* on gill edge scattered, cylindrical or ventricose with blunt or capitate apex, thin walled, 80–150 $\times$ 10–12 μ . *Cap surface* with spines made up from thick-walled golden hyphae with bladder-like swellings and clavate apices.

This description was taken from fresh specimens. The microscopic features coincide with those which Singer, in his excellent study of this species (*Mycologia*, 35, 156), found to be common to all the type specimens included in the above synonymy. The varying diagnoses of the different authors are not so convincing, but in most cases they were not relying on direct observation. To what genus it will eventually be assigned may be left to the future. When I first gathered it, I called it a *Collybia* and as Peck transferred his species to this genus, it can be left there for the present, though eventually it may be found worthy of a genus by itself. Specimen No. 52.

***Omphalia pyxidatoides* n.sp.**

HABITAT: in troops on ground among native plants. University, Rondebosch, 25 May 1948.

Cap 8–10 mm. fleshy in centre, convex, deeply umbilicate, brown (Ochraceous Tawny: Ridgway), dry, smooth or very minutely scaly, mat; margin strongly incurved regular, opaque. *Gills* distant, arcuate, narrow (1–2 mm.) decurrent, in three lengths, tender, buff, rather thick, edge smooth. *Stem* 6–10 mm. long, 1–1½ mm. thick, fairly firm, equal with base slightly swollen, same colour as stem, striate fibrillose. *Flesh* white. *Taste* mild. *Smell* none. *Spores* in mass dirty pink, under microscope yellowish; elongate pip-shaped or subfusoid, 10–11 $\times$ 5–5½ μ smooth. *Basidia* 4-spored. *Cystidia* absent; gill edge fertile. *Cap surface* with septate hyphae about 10 μ diameter. Specimen No. 44.

Omphalia pyxidatoides Pearson, sp. nov. Ad terram in herbis. Rondebosch, Maio 1948. *Pileus* 8–10 mm. convexus, centro carnosus valde umbilicatus, ochraceo-brunneus, siccus, impolitus, laevis vel minutissime squamulosus; margine valde incurvo, laevi, opaco. *Lamellae* distantes arcuatae, angustae, decurrentes, teneres, aliquanto crassae, pallide alutaceae; acie laevi. *Stipes* 6–10 mm. longus, 1–1½ mm. crassus, subfirmus basi leviter

inflatus, pileo concolor, fibrilloso-striatus. *Caro* alba, insapora et inodora. *Sporae* in cumulo sordide roseolae, sub microscopo luteolae; obovatae apiculatae vel subfusoidae, $10-11 \times 5-5\frac{1}{2}\mu$, laeves. *Basidia* tetraspora. *Cystidia* nulla; acie lamellarum fertili. *Cutis pilei* ex hyphis circa 10μ diametro composita.

Lentinus omphalodes Fr.var. **Africanus** n.var.

HABITAT: an old stump under camphor trees in dense imbricate sessile clusters; Tokai Forest, 3 June 1948.

Cap 1-3 cm., shell-shaped, subfleshy, brownish buff or with pink tinge towards margin, in centre brown and densely tomentose, moist, smooth, polished; margin incurved at first, regular or wavy, smooth, opaque. *Gills* crowded, very narrow, linear, radiating from a point not well defined and with short lamellae near radiating point, thin, coarsely serrate, buff coloured. *Stem* none; the carpophore is attached to the wood by a scarcely perceptible thickening of the cuticle of the cap. *Flesh* dark horn colour. *Taste* bitter and rather peppery. *Smell* nil. *Spore powder* pure white. *Spores* hyaline under microscope, globose or subglobose $4\frac{1}{2}-5 \times 4-4\frac{1}{2}\mu$, 1-guttulate, smooth when seen with low magnification but minutely echinulate in oil immersion, strongly amyloid (dark violet under microscope in chloral iodine). *Cystidia* scattered on gill edge, broadly lanceolate, $8-10\mu$ wide. Specimen No. 60.

This variety differs from the type in the absence of stem, the almost globose smaller spores and the bitter rather peppery flesh.

(A typo differt stipite absente, sporis minoris fere globatis, et carne sapore amaro vel acriori.)

Russula

Only half a dozen species were collected, most of our common Russulae being entirely absent. *Russula capensis*, as described below, is the dominant species in the pine woods. Its only serious rival is *R. drimeia* which occurs in many vivid and variegated colours. The scarlet *R. emetica* and its satellites were not seen, but on a few occasions we came across the acrid *R. fallax* Fr. sensu Cooke, typical in colour, the cap being crimson with dark olive centre. *R. cyanoxantha* was absent, but its double *R. grisea* Fr. is fairly common, the colours of the cap tending to be much the same as *R. cyanoxantha*, lilaceous rather than grey; but the spores are creamy instead of pure white and there are other differences. Small groups of *R. sororia* were fairly common. *R. xerampelina*, showing the green reaction to iron sulphate, was only gathered once.

Russula capensis n.sp. (Pl. 18)

HABITAT: very abundant on the ground in the pine woods of the Cape district, April-July 1948.

Cap 5-10 cm., fleshy, very viscid, shallow-convex then expanded with depressed centre, surface minutely and closely granular, colour very varied: dingy pink, crimson with dark centre, russet brown, yellow ochre, etc.; peels to disk; margin smooth, less frequently striate-sulcate. *Gills* crowded at first, subdistant when fully expanded, brittle, adnexed with or without emargination, often forked near stem, usually blunt at cap margin, attenuated towards stem, 5-10 mm. wide, anastomosing at base, white at first, then cream and finally deep ochre and powdery with spores. *Stem*

central, sometimes excentric, 4–6 cm. long, 1–2 cm. thick, soon spongy and fragile, equal, clavate or with slightly swollen apex, white, rugulose, striate with fine veins. *Flesh* white unchangeable. *Taste* mild or with a doubtful slight acidity. *Smell* none or faint. *Chemical reaction*: FeSO_4 grey on flesh, none immediately on stem then pale salmon. *Spore powder*: deep ochre G–H of Crawshay's chart. *Spores* broadly ovoid or sub-globose, $8\text{--}10 \times 6\frac{1}{2}\text{--}8\ \mu$ amyloid, surface ornamented with warts and a partial or complete network of thin lines. *Cystidia* sparse on gill edge, $6\text{--}7\ \mu$ wide, blue-black in sulphovanillin, also present in cap when fresh but more slender and fish-like.

This is the commonest *Russula* in the Cape district and grows in vast quantities under the pine trees of different species: *Pinus pinaster*, *pinex*, *radiata*, etc. It is remarkably varied in colour. As it emerges from the ground particles of soil usually adhere to the viscid cap. It is the favourite food of the grey squirrel which has become acclimatized too successfully in South Africa and seems to take a delight in turning over the carpophores of *Russula capensis*, leaving them stalk upwards on the ground. Specimen No. 14.

Russula capensis Pearson, sp. nov. Ad terram in pinetis, copiosissime. Aprile-Julio 1948; ubique in regione Capense. *Pileus* 5–10 cm. carnosus, viscidissimus, e convexo explanato-depressus, variegatus: sordide roseus, ruber, purpureus centro obscuriore, fuscus, vel ochraceus, margine plerumque laevi vel etiam striato-sulcato; cute secernebilibi. *Lamellae* confertae demum substantes, aequales, postice attenuato-adnexae vel liberae, hinc inde bifidae 5–10 mm. latae, in fundo venoso-coniunctae, ex albis cremeae, denique ochraceae et sporis pulverulentae. *Stipes* 4–6 cm. longus, 1–2 cm. crassus, mox spongioso-fartus et fragilis, aequalis, clavatus vel apice inflatus, rugulosus, subtiliter venoso-striolatus. *Caro* alba immutabilis. *Sapor* mitis vel leviter et dubite sub-acer. *Odor* vix sensibilis. *Sporae* in massa ochraceae G–H de Crawshay. *Sporae* sub-globosae $8\text{--}10 \times 6\frac{1}{2}\text{--}8\ \mu$ amyloideae verrucosae subtiliter reticulatae. *Cystidia* in acie lamellarum, non copiosa, fusioidea $6\text{--}7\ \mu$ lata reactiva sulfovanilico nigro caerulescentia. Dermatocystidia teniora in speciminibus vivis adsunt, etiam SV. caerulescentia.

Pholiota pseudo-erebia n.sp.

HABITAT: on sandy ground or attached to woody debris in troops or fasciculate. Table Mountain, 1 May 1948.

Pileus 1–5 cm., fleshy, semi-globose then flat, finally depressed, cocoa brown, often with pale margin drying to cinnamon buff, dry, not peeling, mat with granular surface; margin incurved at first regular or ragged without striation, white veil sometimes present in fragments. *Gills* crowded at first subdistant, later wedge-shaped or subventricose, 5–8 mm. wide, several lengths, adnate, fragile, sometimes veined, rather thick, cocoa brown edge obtuse. *Stem* 1–4 cm. long, 3–7 mm. wide, rather thicker above but with base often swollen, hollow, fairly tough, white, minutely fibrillose above ring, white and rather shaggy below, brown when handled. *Ring* membranous, single, persistent or fugacious when old, narrow, woolly white, or brown with spores on upper side. *Flesh* reddish buff; no taste or smell. *Spores* in mass rusty brown (Antique Brown: Ridgway); under microscope yellow translucent, elliptical with inconspicuous apicule, $7\text{--}8 \times 5\text{--}5\frac{1}{2}\ \mu$ smooth, multi-guttulate. *Cystidia* on sterile gill edge with tufted cylindrical or slightly ventricose cells, $7\text{--}8\ \mu$ wide, rather thick-walled. *Cap surface* of rather loose texture with septate hyphae $8\text{--}10\ \mu$ wide. Specimen No. 26.

Pholiota pseudo-erebia Pearson, sp. nov. In loco arenoso inter fragmenta lignea, gregaria vel caespitosa. Table Mountain, Maio 1948. *Pileus* carnosus 1-5 cm. e semi-globato plano-depressus, brunneus, saepe margine pallidiore dein fulvido-cinnamoneus, siccus, impolitus; margine primitus incurvato vel eroso, opaco, velo albo interdum in fragmentis praedito. *Lamellae* primo confertae dein subdistantes 5-8 mm. latae, cuneiformes, adnatae, inaequales, fragiles, modice crassae, brunneae, acie obtusa. *Stipes* 1-4 cm. longus, 3-7 mm. crassus, sub-elasticus, cavus, basi saepe dilatato, sursum albus minute fibrillosus, deorsum asperius, tactu brunnescens. *Annulus* membranaceus, simplex, angustus, albus, supra lanosus, vetustate fugax. *Caro* rufo-fulvida. *Sapor* mitis. *Odor* nullus. *Sporae* in cumulo ferrugineae; sub microscopo flavae translucens, ellipsoideae apiculo sensim visibili $7-8 \times 5-5\frac{1}{2} \mu$ laeves. *Cystidia* fasciculatim in acie lamellarum, cylindrica vel leviter ventricosa $7-8 \mu$ spissa. *Cutis pilei* ex hyphis $8-10 \mu$ latis, laxe intertextis composita.

***Pholiota parva* n.sp.**

HABITAT: gregarious on sandy ground. Cecilia plantation, 23 May 1948.

Cap 7-12 mm., subfleshy, semi-globate, ochraceous, dry, minutely tomentose sub lente; margin incurved at first, regular, smooth, opaque, white with fragments of veil. *Gills* distant, arcuate, broad (up to 6 mm.) of two lengths, adnate with decurrent tooth, thin, ochraceous, smooth or slightly eroded. *Stem* $2-2\frac{1}{2}$ cm. long, 2-4 mm. thick, equal with base slightly swollen, solid, firm, ochraceous except at white apex, fibrillose. *Ring* membranaceous, single, white, subfugacious. *Flesh* white, but brown outline near cuticle; horny over gills. *Smell* pleasant. *Spores* in mass ochraceous, under microscope yellow translucent, elliptical with scarcely visible apicule, $7-9 \times 5-6 \mu$, 1 guttulate, smooth. *Basidia* 4-spored. *Cystidia* on gill edge cylindrical with obtuse apex, $7-8 \mu$ wide, thin-walled. Specimen No. 40.

Pholiota parva Pearson, sp. nov. Ad terram arenosam; gregaria. Maio 1948. *Pileus* 7-12 mm. carnosus, hemisphericus, ochraceus, siccus, minute tomentosus; margine primitus incurvo, laevi opaco, fragmentis veli albi praedito. *Lamellae* distantes, arcuatae usque ad 6 mm. latae, alternantes, adnatae denti decurrenti, tenues, ochraceae, acie laevi vel minute erosa. *Stipes* $2-2\frac{1}{2}$ cm. longus 2-4 mm. crassus, teres basi leviter incrassato, firmus, solidus, fibrillosus, deorsum ochraceus, sursum albidus. *Annulus* membranaceus, albus angustus, simplex, sub-fugax. *Caro* alba. *Odor* gratus. *Sporae* in cumulo ochraceae; sub microscopo flavae translucens, $7-9 \times 5-6 \mu$ apiculo vix visibili, laeves. *Basidia* tetraspora. *Cystidia* in acie lamellarum cylindrica $7-8 \mu$ crassa.

***Hebeloma angustispermum* n.sp.**

HABITAT: in troops on ground under *Pinus pinea*, Bergvliet, Retreat, 26 May 1948.

Cap 2-6 cm., fleshy, viscid, shallow-convex then flat, buff with darker centre then rusty brown, peels, smooth, polished; margin slightly incurved at first, regular, opaque; no veil seen. *Gills* crowded, linear, narrow, of several lengths, adnate, rather resilient, thin, snuff brown, edge whitish eroded. *Stem* 2-6 cm. long, 3-5 mm. wide, equal or slightly thickened above and usually swollen at base, dry, white then dingy brown, granular at apex, squamulose elsewhere, rather cartilaginous. *Flesh* white then buff. *Taste* mild but bitter after mastication. *Smell* faint of mushroom. *Spores* in mass snuff brown; under microscope brown subopaque, oblong-ellipsoid, $8-10 \times 4-4\frac{1}{2} \mu$, minutely verrucose. *Cystidia* on gill edge cylindrical $5-7 \mu$ wide. Specimen No. 46.

Hebeloma angustispermum Pearson, sp. nov. Gregaria ad terram sub *Pinus pinea*, Maio 1948. *Pileus* 2–6 cm. carnosus, viscidus, e convexo planus, alutaceo-pallidus, centro obscuriori dein ferruginosus, laevis, politus; cute secernibili; margine primitus incurvato, laevi, opaco. *Lamellae* confertae, lineares, adnatae, angustae, modice elasticae, tenues, brunneo-tabacinae, acie alba erosa. *Stipes* 2–6 cm. longus, 3–5 mm. crassus, siccus aequalis vel apice incrassatus, basi plerumque aliquantulum inflato, solidus dein cavus, sub-cartilagineus; albus demum sordide brunneus, sursum granulatus, deorsum squamulosus. *Caro* alba dein pallide alutacea. *Sapor* mitis dein amarus. *Odor* sub-nullus vel leviter funginus. *Sporae* in pulvere tabacino-brunneae: sub microscopo brunneae sub-opacae; oblongo-ellipsoideae, $8-10 \times 4-4\frac{1}{2} \mu$ minute verrucosae. *Cellulae* in acie lamellarum cylindricae $5-7 \mu$ latae.

***Flammula papillata* n.sp.**

HABITAT: on ground in small troop. Collected by Miss Walgate on University grounds, Rondebosch, 2 June 1948.

Cap 2–3 cm., fleshy, shallow convex then expanded and depressed around small central umbo, sulphur yellow with rusty brown centre, dark ochraceous when old, minutely fibrillose, cuticle slightly overlapping gills; margin incurved at first, regular, smooth, opaque, remnants of reddish brown veil adhering to edge. *Gills* crowded, linear, narrow, unequal, adnate with decurrent tooth, fragile, thin, pallid at first, then yellowish brown, finally brown. *Stem* 2–4 cm. long, 3–4 mm. thick, inflated upwards, base acuminate, cartilaginous, sulphur yellow above, rusty brown below, striate fibrillose, with fibrillose remnants at base. *Flesh* sulphur yellow, reddish brown under umbo, in stem rusty brown. *Taste* mild. *Smell* none. *Spores* in mass snuff brown; under microscope translucent yellow, bean-shaped $7-7\frac{1}{2} \times 4-4\frac{1}{2} \mu$, smooth. *Cystidia* on gill edge sparse, broadly ventricose, $12-15 \mu$ wide, pointed or blunt with thin walls. Specimen No. 56a.

Flammula papillata Pearson, sp. nov. Ad terram gregatim. Rondebosch, Junio 1948. *Pileus* 2–3 cm. carnosus, e convexo explanatus, circum parvam umbonem papillatam depressus, sulfureus centro ferrugineo, vetusto obscure-ochraceus, minute fibrillosus, cute leviter lamellas superanti; margine primitus incurvato, regulari, laevi, opaco, fragmentis veli ferruginea adhaerentibus. *Lamellae* confertae, lineares, angustae, inaequales, adnatae, denti decurrenti, fragiles, tenues, pallidae dein flavo-brunneae, denique brunneae. *Stipes* 2–4 cm. longus, 3–4 mm. crassus, versus apicem inflatus, basi acuminata, cartilagineus, sursum sulfureus, deorsum ferrugineus, striato-fibrillosus, basi fragmento-fibrillosus. *Caro* pilei sulfurea sub umbone ferruginea; stipite robiginosa; insapora; inodora. *Sporae* in cumulo obscure brunneae; sub microscopo flavae translucetes, phaseoliformes $7-7\frac{1}{2} \times 4-4\frac{1}{2} \mu$ laeves. *Cystidia* in acie lamellarum sparsa, late ventricosa $12-15 \mu$ acuta vel obtusa tenuiter tunicatae.

***Flammula luxurians* n.sp.**

HABITAT: gregarious on ground or on stumps in pine woods, Valley Lustra, Stellenbosch, 29 May 1948; and elsewhere.

Cap very variable in size, 2–6 cm., with thick flesh, convex or gibbous, dry, covered at first with scurfy golden arachnoid veil which rubs off leaving reddish ochre tomentose surface; margin incurved at first, wavy, often lobed in large specimens. *Gills* crowded, linear, very narrow, unequal, decurrent or subdecurrent, elastic, rather thick, golden yellow with an olive tint, reddish brown to touch, edge somewhat blunt. *Stem* central or excentric, short or long and sometime rooting with thick base, equal or clavate, soft but elastic, soon hollow, whitish with striate fibrils at first, dingy ochre underneath. *Flesh* rusty red buff. *Taste* bitter. *Smell* pleasant.

Spores in mass bright rusty brown; under microscope golden yellow rather coarsely verrucose, elliptical subamygdaliform, $7\frac{1}{2}$ – $8\frac{1}{2} \times 5$ – 6μ . *Basidia* 4-spored. *Cystidia* on gill edge forming a fringe of narrow hairs with water drop on apex when seen on naked gill. Specimen No. 48.

Flammula luxurians Pearson, sp.nov. Ad truncos vetustos pini et ad terram gregatim saepe luxurians. Stellenbosch, Autumno 1948. *Pileus* 2–6 cm. carnosus, convexus vel gibbosus, primitus velo aureo-furfuraceo tectus, denique superficie attrita tomentosa obscure rubro-ochracea; margine undulato vel plicato. *Lamellae* confertae, lineares, angustissimae, inaequales, decurrentes vel subdecurrentes, elasticae, modice crassae, primo aureo-flavae et olivaceo-tinctae, tactu rubro-brunneae. *Stipes* centralis vel excentricus, brevis vel longus, aequalis vel clavatus, basi saepe tumidus et radicans, mollis sed elasticus mox cavus, sordide ochraceus, fibrillis albidis striatis primitus tectus. *Caro* pallide ferruginea. *Sapor* amarus. *Odor* gratus. *Sporae* in massa ferrugineae; sub microscopo aureo-flavae ellipticae subamygdaliformes $7\frac{1}{2}$ – $8\frac{1}{2} \times 5$ – 6μ manifeste verrucosae. *Basidia* tetraspora. *Cystidia*: acies lamellarum crinibus angustis abundanter praedita.

***Flammula laeti-lamellata* n.sp.**

HABITAT: on ground among native plants. Karbonkelberg, C.P., 6 June 1948.

Cap 2–3 cm., fleshy semi-globate, golden yellow or bright ochraceous turning to dingy buff, moist, peels, smooth, polished, margin regular, smooth, opaque. *Gills* crowded or subdistant, arcuate, very broad (about 8 mm.) two lengths, adnate, thin, bright ochre on face, reddish ochre looked at from below, edge smooth reddish ochre. *Stem* short (2–3 cm.), 6–7 mm. thick, equal, base sometimes acuminate, ochraceous striate-fibrillose, a vague ring-like zone sometimes at apex. *Flesh* yellowish buff. *Taste* bitter. *Smell* none. *Spores* in mass brown (near Antique Brown of Ridgway) under microscope golden subtranslucent, 9 – $10 \times 5\frac{1}{2}$ – 6μ , verrucose elliptical. *Basidia* 4-spored. *Cystidia* on gill edge small clavate cells 5– 6μ diameter. *Cap surface* with very closely agglutinated septate hyphae. Specimen No. 64.

Flammula laeti-lamellata Pearson, sp.nov. Ad terram inter herbis indigenis. Karbonkelberg, Junio 1948. *Pileus* 2–3 cm. carnosus, semiglobatus, primitus aureo-flavus vel clario-ochraceus dein sordide alutaceus, cute uvide secernibili, laevis, politus; margine opaco, regulari, laevi. *Lamellae* confertae vel subdistantes, arcuatae, latissimae (8 mm.) alternantes, adnatae, tenues, clario-flavae acie rufescente. *Stipes* brevis, 2–3 cm. longus 6–7 mm. crassus, aequalis vel basi acuminato, ochraceus, striatus, leviter fibrillosus, apice zona annulata vaga aliquando videtur. *Caro* alutacea. *Sapor* amarus. *Odor* nullus. *Sporae* in cumulo brunneae sub microscopo aureae, ellipsoideae, 9 – $10 \times 5\frac{1}{2}$ – 6μ verrucosae. *Basidia* tetraspora. *Cystidia* in acie lamellarum parva, clavata 5– 6μ lata. *Cutis pilei* ex hyphis dense agglutinatis composita.

***Naucoria (Alnicola) macrospora* Lange**

The main features of the agaric thus determined are the very large elongate lemon, almost spindle-shaped warted spores, mostly 17 – 18×7 – $7\frac{1}{2} \mu$, some much larger, the clavate cheilocystidia and the hymeniform cuticle of the cap consisting of globose cells 25– 30μ wide. The cap was the colour of milky coffee and radiately wrinkled. There is some doubt whether this is distinct from *Alnicola submelinoides* Kühner. Full details were not taken and the habitat not noted.

***Cortinarius (Phlegmacium) brunneo-limosus* n.sp.**

HABITAT: in troops under pine and gum trees, near Stellenbosch, 23 June 1948.

Cap 2–6 cm., fleshy convex then flat and depressed, golden ochre covered with reddish brown gluten, then dark bay brown, smooth, polished when dry; margin incurved at first, regular, smooth, opaque. *Gills* crowded, linear or ventricose sinuate adnate, thin, cinnamon-gold then dark cinnamon, edge rather wavy. *Stem* 3–6 cm. long, 5–15 mm. thick, round or flattened, base bulbous often rooting, yellow, striate, fibrillose, firm, dry, veil faintly visible on apex of stem. *Flesh* whitish buff. *Taste* bitter. No smell. *Spores* in mass Amber Brown (Ridgway); under microscope golden pip-shaped, $7-9 \times 5-6 \mu$ minutely warted, with rather thick wall. *Basidia* two-spored. *Cystidia* on gill edge cylindrical $5-6 \mu$ wide. *Cap surface* with hyphae of various diameters up to 18μ wide. Specimen No. 74.

As no arachnoid veil was apparent, I have hesitated whether to place the above in the 'Fulvidula' group of *Flammula* or the 'Phlegmacium' section of *Cortinarius*. The general characters point to the latter, but further study may make it necessary to transfer it to another genus. Meanwhile, such a striking species should not be left unrecorded.

Cortinarius (Phlegmacium) brunneo-limosus Pearson, sp.nov. Gregaria ad terram sub pinis et Eucalypticis. Stellenbosch, Junio 1948. *Pileus* 2–6 cm. carnosus, viscosus, e convexo plano-depressus, aureo-ochraceus, glutino badio obscuro tectus, sicco politus; margine primo incurvo, laevi, opaco. *Lamellae* confertae, lineares vel ventricosae, inaequales, adnatae sinuatae, tenues, acie sub-undulatae, aureo-cinnamomeae dein obscuro-cinnamomeae. *Stipes* 3–6 cm. longus, 5–15 mm. crassus, teres vel compressus, basi bulbosus et saepe radicante, siccus, firmus, flavus, striato-fibrillosus, apice velo vix visibili. *Caro* pallide luteola. *Sapor* amarus. *Odor* nullus. *Sporae* in cumulo brunneae; sub microscopo aureae, ellipsoideae apiculatae $7-9 \times 5-6 \mu$ minute verrucosae. *Basidia* bispora. *Cystidia* in acie lamellarum cylindrica $5-6 \mu$ lata. *Cutis pilei* ex hyphis variis diametris usque 18μ composita.

***Cortinarius (Dermocybe) radio-fibrillosus* n.sp.**

HABITAT: fasciculate on damp ground under or near *Populus canescens*; Ida's Valley Farm, near Stellenbosch, 30 May 1948.

Cap 2–5 cm., dry, conical then campanulate with pointed or blunt umbo, ferruginous brown, radiately fibrillose like an *Inocybe*, smooth at first then sulcate to disk, margin regular or wavy, smooth yellowish brown, arachnoid veil near edge. *Gills* subdistant, adnate then free, ventricose in large specimens, linear in small, broad 5–10 mm., several lengths, fragile, thin, edge wavy slightly eroded pallid, light brown at first, darker, like cap, later. *Stem* 4–8 cm. long, 3–7 mm. thick, equal, base more or less acuminate and with white tomentum, hollow, dry, fibrillose-striate, silky, pallid above, dingy brown below, remnants of veil sometimes present. *Flesh* watery ferruginous, brown in old specimens, pale buff or whitish in young ones. *Taste* mild, rancid. *Smell* pleasant. *Spores* in mass rusty brown (Argus Brown: Ridgway) under microscope brown subopaque, elliptical with inconspicuous apiculus $8-9 \times 5-5\frac{1}{2} \mu$ verrucose. *Cystidia*: none. *Cap surface* with septate hyphae $12-16 \mu$ diameter constricted at septae. Specimen No. 56.

This species has, perhaps, more affinity with some of the *Cortinari* of the *Hydrocybe* section rather than with the *Dermocybes*, but in view of its radiately fibrillose cap it is placed with the latter.

Cortinarius (Dermocybe) radio-fibrillosus Pearson, sp.nov. Caespitosus ad terram in loco humido prope *Populum canescentem*. Stellenbosch, Maio 1948. *Pileus* carnosus 2–5 cm.

siccus, e conico expansus, umbone acuto vel obtuso, ferruginosus, radiate fibrillosus, vetusto sulcatus; margine regulari vel undulato, opaco, vestigiis cortinae luteolae praedito. *Lamellae* sub-distantes, ventricosae vel lineares, latae, adnatae dein liberae, fragiles, inaequales, tenues, pallide brunneae demum ferrugineae. *Stipes* 4–8 cm. longus, 3–7 mm. crassus, teres, ad basim plus minusque acuminatus, striato-fibrillosus, sericeus, sursum pallidus, deorsum sordide brunneus, veli fragmentis interdum praeditus. *Caro* dilute fulvida vel in statu juvenile albida. *Sapor* mitis dein rancidus. *Odor* gratus. *Sporae* in cumulo ferrugineae; sub microscopo brunneae sub-opacae, ellipsoideae sensim apiculatae, $8-9 \times 5-5\frac{1}{2} \mu$ verrucosae. *Cystidia* nulla. *Cutis pilei* ex hyphis $12-16 \mu$ latis, ad septa constrictis composita.

***Inocybe congregata* n.sp.**

HABITAT: on ground at the edge of woods, June 1948; Hohenort, Constantia and Groot Constantia in dense troops; thousands were clustered together, mostly in tufts.

Cap $1-1\frac{1}{2}$ cm., fleshy in centre, convex with small central papilla, snuff brown or paler (Brussels Brown: Ridgway) radiately fibrillose, sometimes breaking up into rather shaggy scales; margin regular and smooth. *Gills* subdistant, ventricose, rather wide for so small an agaric, adnate then free, fragile, thin, snuff brown, edge smooth. *Stem* 2–4 cm. long, 1 mm. thick, equal, base slightly swollen, firm, pruinose, pale reddish brown, apex with violet tint. *Flesh* white in cap, buff in stem with white centre and sometimes violaceous at apex. *Taste* mild. *Smell* none. *Spores* in mass, snuff brown, almond-shaped or subcitriform, $7\frac{1}{2}-10 \times 5-5\frac{1}{2} \mu$ with large guttule, smooth. *Cystidia* mostly long and slender, pointed, with or without cristulate apex, $60-75 \times 10-20 \mu$ brown, thick-walled. *Cap surface* with brown hyphae 4–5 μ diameter.

This species is closely related to the group comprising *Inocybe cinnamata*, *obscura* and *pusio*, from which it differs in several minor details, but chiefly in its densely clustered habit, an unusual and remarkable feature for an *Inocybe*. Specimen No. 62.

Inocybe congregata Pearson, sp.nov. Dense gregaria et caespitosa, ad margines silvarum. Hohenort et Groot Constantia, C.P., Junio 1948. *Pileus* $1-1\frac{1}{2}$ cm. centro carnosus, convexus, disco parva papilla praeditus, tabacino-brunneus vel pallidior, radiate fibrillosus interdum squamuloso-diffractus; margine regulari et laevi. *Lamellae* subdistantes, ventricosae, latae, adnatae dein liberae, fragiles, tenues, tabacino-brunneae, acie laevi. *Stipes* 2–4 cm. longus, 1 mm. crassus, aequalis, basi leviter inflatus, firmus, pruinosis, pallide rufo-brunneus apice violaceo-tinctus. *Caro* pilei alba, stipitis luteola in centro alba et interdum apice violacea; insapora et inodora. *Sporae* in cumulo tabacinae, amygdaliformes vel sub-citriniformes, $7\frac{1}{2}-10 \times 5-5\frac{1}{2} \mu$ 1-guttulata, laeves. *Cystidia* fusioideo-ventricosa plerumque longa, exilia et acuta, apice muricellata vel laevi, brunneo-tincta, $60-75 \times 10-20 \mu$. *Cutis pilei* ex hyphis 4–5 μ latis composita.

***Inocybe mixtilis* (Britz.) Kühner in Bull. S.M. Fr. XLIX, 88 = *Inocybe scabella* Cke. non Fr.**

HABITAT: in troops on bare ground; Hohenort Woods, Constantia, June 1948.

Cap fleshy, $2-3\frac{1}{2}$ cm., convex or gibbous then expanded with shallow umbo, straw colour then darker, immature forms white with slight yellow tint, radiately fibrillose, usually smooth and rather silky, margin regular or wavy, smooth, sometimes plicate. *Gills* crowded, ventricose, 4–5 mm., unequal, adnate, white then brown, edge white eroded. *Stem* 2–4 cm. long,

4–8 mm. thick, equal or slightly thicker above, marginately bulbous below, white or with slight yellow tint, pruinose at apex, naked or very minutely fibrillose-striate. *Flesh* white. *Taste* mild. *Smell* strong of new meal. *Spores* in mass dark snuff brown, oblong nodulose, mostly six nodules in outline, $7-8 \times 5-5\frac{1}{2} \mu$. *Basidia* 4-spored. *Cystidia* on gill edge and face ventricose with short neck, thick walled in tufts $45-50 \times 16-20 \mu$, mixed with thin-walled pyriform para-cystidia $15-20 \mu$ wide. *Cap surface* with allantiform cells, mostly $45-54 \mu$ wide, contracted at septae.

White forms were mixed with the normal ones and these were gathered in several other places by themselves. The microscopic characters are the same except that the spores are colourless. These immature specimens shed no spores and were very puzzling until I collected the two forms growing together. The white one looks like a *Lepiota* without a ring.

British mycologists have usually called this species *Inocybe scabella* Fr. more or less in accordance with Cooke's Illustration 441 (402), but this hardly corresponds to the Friesian diagnosis. Heim accepted this interpretation. In America it is usually determined as *I. trechispora* Berk., but this is a more slender agaric, with different colouring and a small but projecting umbo. Kühner used the binomial *I. mixtilis* Britz. and though the Britzelmayer description is not entirely satisfactory, we may hope that Kühner's interpretation will be accepted. Specimen No. 68a.

***Psilocybe cylindrispora* n.sp.**

HABITAT: in troop on bare soil. Karbonkelberg, 6 June 1948.

Cap 2–3 cm., fleshy, hygrophanous, convex, dark umber brown drying to buff, smooth, mat, margin striate. *Gills* crowded, ventricose, narrow, adnexed, fragile, thin, white at first, then dark smoky with purplish tinge. *Stem* 2–4 cm. long, 4–5 mm. thick, equal, firm, hollow, white, striate-fibrillose delicately pruinose. *Flesh* dirty white in cap, white in stem; no taste or smell. *Spores* in mass blackish brown; under microscope brown subtranslucent, cylindrical $9-10 \times 3\frac{1}{2}-4 \mu$ smooth, with germinative pore. *Cystidia* on gill edge cylindric, $7-8 \mu$ thick with thin walls. *Cap surface* hymeniform with sack-shaped cells $18-25 \mu$ wide. Specimen No. 67.

Psilocybe cylindrispora Pearson, sp.nov. Gregaria ad terram denudatum. Karbonkelberg, Junio 1948. *Pileus* 2–3 cm. carnosus, hygrophanus, convexus, obscure umbrinus dein alutaceus, impolitus, margine striatulo. *Lamellae* confertae, ventricosae, angustae, adnexae, tenues, albae dein fumoso-purpureo tinctae. *Stipes* 2–4 cm. longus, 4–5 mm. latus, aequales, firmus, cavus, albus, delicate pruinoso-fibrillosus. *Caro* pilei sordide alba, stipitis alba; insapora et inodora. *Sporae* in cumulo nigro-brunneae; sub microscopo brunneae, sub-opacae; cylindricae $9-10 \times 3\frac{1}{2}-4 \mu$ laeves, foramine germinativo visibili. *Cystidia* ad aciem lamellarum clavata $7-8 \mu$ crassa. *Cutis pilei* cellulis saccoideis $18-25 \mu$ latis constructa.

***Psathyrella barlae* (Bres.) Smith (1941) = *Psathyra barlae* Bres. *Fung. Trid.* 1, 84–91 (1887), and *Icon. Myc.* p. 870 (1931); ? = *Drosophila bipellis* Qué. *Fl. Myc.* (1888).**

HABITAT: on ground in troops in mixed woods, Tokai Forest, May 1948.

Cap rather fleshy in centre, membranaceous elsewhere, 3–6 cm. when expanded; convex or gibbous then flat, purplish buff drying to buff, hygrophanous, smooth, often rugulose or plicate; margin regular or wavy, striate half way, white veil present in fragments when young. *Gills* crowded,

subdistant later when fully expanded, ventricose, 4–8 mm. broad, adnate with decurrent tooth then free, fragile, thin, edge pallid eroded, grey at first, on face view somewhat mottled, later blackish drab. *Stem* 8–10 cm. long, 5–8 mm. thick, equal, rather flexuose, base subbulbous and white tomentose, soft, hollow, silky striate fibrillose, vinaceous hyaline, white at apex. *Flesh* in cap horny colour when wet, drying to pale buff; in stem vinaceous hyaline drying to white. *Taste* mild. *Smell* strong, unpleasant. *Spores* in mass sooty black, under microscope dark brown, elliptical $12-14 \times 6\frac{1}{2}-7 \mu$, smooth, with germinative pore. *Basidia* with 4 sterigmata. *Cystidia* on gill edge ventricose, flask-shaped in tufts $40-70 \times 17-20 \mu$, thin-walled. *Cap surface* made up of pyriform cells $40-45 \times 20-30 \mu$.

The above description taken from the Cape specimens differs slightly from the original diagnosis, but hardly enough to call for a change of name. Specimen No. 25.

***Psathyrella griseola* n.sp.**

HABITAT: in troops on sandy soil, Paardeberg, 29 April 1948; Karbonkelberg, 6 June 1948.

Cap 1–2 cm., fleshy in centre, hygrophanous, convex then flat with shallow umbo, sometimes more conical, at first brown drying to grey with darker umbo, smooth or minutely fibrillose-scaly with smooth polished disk, striate and splitting when old. *Gills* distant when cap expands, linear, $1-1\frac{1}{2}$ mm. wide, adnate or adnexed, fragile, thin, one length, grey with black edge as if deliquescing at edge only. *Stem* 2–3 cm. long, 2–3 mm. thick, with swollen base, fragile, brittle, white, striate silky fibrillose. *Flesh* dark or pale grey, without taste or smell. *Spores* in mass brownish black; under microscope dark brown opaque, ellipsoid-subamygdaliform, $9-11 \times 5\frac{1}{2}-6 \mu$, smooth, germinative pore conspicuous. *Cystidia* sparse, clavate or flask-shaped with blunt apex about $40 \times 12-14 \mu$, sometimes absent. *Cap surface* with septate hyphae $10-30 \mu$ wide. Specimen No. 63.

Psathyrella griseola Pearson, sp.nov. Gregatim ad terram arenosam; Paardeberg, April; Karbonkulberg, Junio 1948. *Pileus* centro carnosus, hygrophanus, e convexo expansus vel conicus umbonatus, initio brunneus mox canescens umbone obscuriori, glaber vel minute fibrilloso-squamulosus disco polito, vetustate striatus vel radiato-fissus. *Lamellae* distantes, lineares $1-1\frac{1}{2}$ mm. latae, adnatae vel adnexae, fragiles, tenues, aequales, griseae, acie nigra. *Stipes* 2–3 cm. longus, 2–3 mm. crassus, teres, basi incrassatus, fragilis, albus, striato-fibrillosus, sericeus. *Caro* griseola, insapora et inodora. *Sporae* in cumulo brunneonigrae, sub microscopo obscure brunneae opacae; ellipsoideae sub-amygdaliformes, poro germinativo praeditae. *Cheilocystidia* lageniformia vel clavata circa $40 \times 12-14 \mu$ sparsa vel nulla. *Cutis pilei* hyphis $10-30 \mu$ crassis praedita.

***Psathyrella praelonga* n.sp.**

HABITAT: on ground in garden. Rosebank, 20 May 1948.

Cap 1 cm. wide, $1\frac{1}{2}$ cm. long, before expansion, when young brown all over, later brown at disk, grey elsewhere, striate, delicately pruinose. *Gills* crowded, linear $2-2\frac{1}{2}$ mm. wide, adnexed, tender, thin, brown, edge white slightly eroded. *Stem* 5–6 cm. long, about 2 mm. thick, equal, base slightly swollen, fairly elastic but soft, white, naked, polished. *Flesh* in centre only of cap and in stem buff; inodorous. *Spores* under microscope brown in water, dark violet in KOH, broadly oval, smooth $10-11 \times 7\frac{1}{2}-8 \times 5-6 \mu$, germ. pore visible. *Cystidia* ventricose or broadly fiddle-shaped, $35-50 \times 20-25 \mu$.

Cap surface with hyaline globose or sack-shaped warted cells $25\text{--}30\mu$ wide, also scattered narrow long brown thick-walled pointed spines about 3μ wide with swollen base.

This species belongs to the section (or genus) *Pseudo-coprinus* Kühner. Specimen No. 37.

Psathyrella praelonga Pearson, sp.nov. Ad terram cultam. Rosebank, Maio 1948. *Pileus* $1\frac{1}{2}$ cm. longus, 1 cm. latus, membranaceus, cylindricus, brunneus dein griseus, disco brunneo striatus, pruinosis. *Lamellae* confertae, lineares, $2\text{--}2\frac{1}{2}$ mm. latae, aequales, molles, tenues, brunneae, acie alba leviter erosa. *Stipes* 5–6 cm. longus circa 2 mm. crassus, aequalis, basi leviter incrassatus, mollis sed modice elasticus, albus, nudus, politus. *Caro* pileo luteola, stipite alba; inodora. *Sporae* sub microscopo in aqua brunneae, in KOH obscuro violaceae, late ovoideae $10\text{--}11 \times 7\frac{1}{2}\text{--}8 \times 5\text{--}6\mu$ laeves poro germinativo visibili. *Cystidia* late ventricosa v. fidiformia $35\text{--}50 \times 20\text{--}25\mu$. *Cutis pilei* cellulis hyalinis globosis vel obovoideis, verrucosis $25\text{--}30\mu$ latae, etiam sparsis spinis longis acutis brunneis, circa 3μ latae, basi inflato praedita.

***Psathyrella varicosa* n.sp.**

HABITAT: in troop on ground. Tokai Forest, 20 May 1948.

Cap 2–6 cm., thin, hygrophane, conical then flat with rather sharp umbo, when young brown (milky coffee) drying to buff, all smooth at first but when dry the disk only is smooth and the surface elsewhere radiately wrinkled with fine veins; margin regular then wavy, opaque; no veil seen. *Gills* crowded linear, narrow (2–3 mm.), several lengths, adnate, very thin, pale buff, edge white, eroded. *Stem* 6–12 cm. long, 3–4 mm. thick, equal, base slightly swollen, fragile, hollow, smooth, polished, white. *Flesh* pale buff in cap, white in stem. *Taste* mild. *Smell* none. *Spores* in mass snuff brown; under microscope yellow translucent; bean-shaped $6\text{--}7 \times 4\text{--}4\frac{1}{2}\mu$ smooth. *Basidia* 4-spored. *Cystidia* gill edge sterile with sack-shaped or clavate cells $25\text{--}35 \times 12\text{--}13\mu$ thin-walled. *Cap surface* with round cells, $25\text{--}35\mu$ wide. Specimen No. 34.

In spite of its snuff brown spores, this species has all the characteristics of a *Psathyrella*. Mr Alexander Smith informs me that it is closely related to *P. hymenocéphala* (Peck) Smith which differs in its larger spores.

Psathyrella varicosa Pearson, sp.nov. Gregatim ad terram. Tokai Forest, Maio 1948. *Pileus* 2–6 cm. membranaceus, hygrophane, e conico applanatus umbone acutiore, primitus brunneus pallide alutaceus, statu humido laevis, sicco disco levi, alibi radiate rugosis venis subtilibus ornatus; margine regulari demum undulato; velo nullo. *Lamellae* confertae, lineares, angustae, inaequales, adnatae, tenuissimae, pallide alutaceae, acie alba erosa. *Stipes* 6–12 cm. longus, 3–4 mm. crassus, teres basi vix incrassato, fragilis, fistulosus, glaber, albus. *Caro* pileo pallide alutacea, stipite alba; insapora et inodora. *Sporae* in cumulo tabacino-brunneae, sub microscopo flavae translucentes, laeves, phascoliformes $6\text{--}7 \times 4\text{--}4\frac{1}{2}\mu$. *Basidia* tetraspora. *Cystidia* ad aciem sterilem lamellarum saccata vel clavata $25\text{--}35 \times 12\text{--}13\mu$ tenuiter tunicata. *Cutis pilei* e cellulis sphaericis $25\text{--}35\mu$ latis composita.

***Panaeolus fimicoloides* n.sp.**

HABITAT: a small group on ground in grass and under native plants. Karbonkelberg, C.P., 6 June 1948.

Cap subfleshy small, $1\frac{1}{2}\text{--}2\frac{1}{2}$ cm. flat, dark umber brown, dry, smooth, mat; margin smooth, opaque. *Gills* subdistant, ventricose, broad, unequal, adnate, jet black when gathered, edge white eroded. *Stem* $2\frac{1}{2}$ cm. long, 2–3 mm. thick, equal, fragile, dingy blackish grey. *Flesh* watery black or

blackish grey. *Taste* mild, rather rancid. *Smell* none. *Spores* in mass black, under microscope dark brown subopaque, oblong-elliptic truncate $9-10 \times 4\frac{1}{2}-5\mu$ smooth, germinative pore conspicuous. *Basidia* 4-spored. *Cystidia* on gill edge cylindric wavy, with swollen apex $5-6\mu$ diameter. *Cap surface* with pyriform cells $20-25\mu$ wide. Specimen No. 66.

Panaeolus fimicoloides Pearson, sp. nov. Catervatim ad terram in graminis et sub herbis indigenis, Karbonkelberg, Junio 1948. *Pileus* carnosulus, parvus, $1\frac{1}{2}-2\frac{1}{2}$ cm. planus, obscuro-umbrinus, siccus, glaber, impolitus, margine glabro, opaco. *Lamellae* subdistantes, ventricosae, latae, inaequales, adnatae, nigrae, acie alba erosa. *Stipes* $2\frac{1}{2}$ cm. longus, 2-3 mm. crassus, aequalis, fragilis, sordide nigro-griseus. *Caro* nigra aquosa vel nigro grisea, insipida vel aliquantulum rancida, inodora. *Sporae* in massa nigrae, sub microscopo obscuro-brunneae subopacae, oblongo-ellipticae truncatae $9-10 \times 4\frac{1}{2}-5\mu$ laeves, poro germinativo conspicuo. *Basidia* tetraspora. *Cystidia* in acie cylindrica, undulata, apice incrassata, $5-6\mu$ lata. *Cutis pilei* cellulis pyriformis $20-25\mu$ lata praedita.

Panaeolus semi-ovatus (Sow. ex Fr.) Lundell, forma ***exannulatus*** n.f.

HABITAT: on dung. Cape Town, April 1948.

Cap 1-5 cm., ovoid, soft and fleshy, ivory white, viscid, polished when dry, smooth. *Gills* crowded, arcuate, broad, unequal, adnate, thin, mottled black and grey, edge white fimbriate. *Stem* 6-10 cm. long, 4-6 mm. thick, base subbulbous, firm, solid, dry, white above, brownish buff below, striate-fibrillose. *Ring* absent and no trace of veil visible. *Flesh* white. *Taste* mild. *Smell* pleasant. *Spores* in mass black, under microscope black, opaque, elongate-citriform (elliptic from side view), $18-20 \times 9-11\mu$ with germinative pore, smooth. *Cystidia* on sterile gill edge tufted, rather thick-walled, pyriform to clavate with granular contents $35-60 \times 20-25\mu$. *Cap surface* made up of rather thick-walled septate hyphae $12-25\mu$ wide.

This was seen on several occasions always without a ring, but it corresponds so closely to *Anellaria semi-ovata* (Sow. ex Fr.) Pears. & Denn. (= *A. separata* (Linn.) Karst.) that it can hardly be separated from this common species. However, further observations are called for. Mr Alex Smith has pointed out that it appears to be identical with *Panaeolus solidipes* (Peck), but from the original description of this American species the pileus is not viscid and the cuticle breaks up into yellow scales.

Psalliota xanthoderma Genev. var. ***meleagrioides*** n.var.

HABITAT: in troops on the ground under various trees, May and June 1948. Tokai Forest, etc.

Cap fleshy, 4-12 cm., campanulate, usually strikingly flat on disk, when expanded with or without obtuse umbo, silky white but densely or sparsely covered with small, sooty squamules, radiately fibrillose, but sometimes breaking up into concentric black scales. These two forms may grow together but look quite distinct, the one as if smeared over with soot and the other definitely scaly. Margin incurved, regular or wavy, smooth, opaque. *Gills* crowded, linear, rather narrow (5 mm.), unequal, free, fragile, thin, white at first then rosy pink and finally brownish black. *Stem* 4-10 cm. long, 8-10 mm. thick, cylindrical with abruptly projecting marginate bulb, hard, solid then hollow, silky striate, white; when fresh the base when

rubbed turns a brilliant chrome yellow which soon fades. *Ring* superior (sheathed above) membranous, under surface usually with large scales, white, fugacious. *Flesh* white, turns lemon or chrome yellow in bulb when fresh. *Taste* mild. *Smell* faint of 'antiseptic', difficult to define. *Spores* in mass brownish black; under microscope brown, translucent, ovoid, $5-5\frac{1}{2} \times 3\frac{1}{2}-3\frac{3}{4} \mu$, smooth. *Basidia* 4-spored. *Cystidia* gill edge sterile with globose or sack-shaped cells $7-10 \mu$ wide. *Cap surface* with septate hyphae $6-7 \mu$ wide.

Not recommended as an edible, the European and American varieties being poisonous to some people. Specimen No. 59.

P. xanthoderma Genev. (1876) is widely distributed and has many forms and varieties. The type is pure white. The main feature is the quickly fading yellowing of the surface of cap, ring and stem when rubbed, and the more vivid yellow of the flesh in the marginate bulb. In England the variety *obscurata* Maire seems to be more common than the type. This is identical with *P. meleagris* J. Schaeffer, and very closely related to the South African variety as described above. In his 'Studies of the genus *Agaricus*' (*Papers of the Mich. Acad. Sci.* xxv, 125) Alexander H. Smith has pointed out that there are no appreciable differences between this and the American species *P. placomyces* Peck (1878). A slender species with much the same character was described by Berkeley and Broome as *Agaricus* (*Psalliota*) *endoxanthus* Linn. Soc. Journ. Bot. (1871).

Psalliota xanthoderma Genev. var. *meleagrioides* Pearson, var. nov. A typo differt pileo nigro-squamuloso vel pulverulento et bulbo valde et abrupte marginato.

Another variety was collected at Plumstead, C.P., which I have listed with some doubt as *P. xanthoderma* var. *lepiotooides* Maire. In this variety the pileus is not so definitely flat at the disk, the scales are concentric and brown, whilst the bulb is almost round.

Many of the varieties hitherto linked with the *xanthoderma-placomyces* group of *Psalliota* may eventually be considered worthy of specific rank, but this decision can be left to those who have given the group more specialized study than I have.

***Psalliota campestris* (Linn.) sensu lato.**

Like the European forms which are lumped together under this name, the white so-called field mushroom of the Cape district, with its gaiter-like stem, is a composite species which requires special study before it can be determined with any satisfaction. Some of the Cape specimens will probably be more accurately placed as *P. edulis* (Vitt.) J. Schaeffer and F. Möller, since the gill edge is not entirely devoid of cystidia. However, the genus *Psalliota* awaits much further monographic treatment before the very variable members of the tribe can be named decisively.

***Psalliota nobilis* n.sp. (Pl. 19)**

HABITAT: on ground under *Pinus radiata* in a large scattered troop. Tokai Forest, 3 June 1948.

Cap up to 24 cm. wide, very thick, fleshy, semi-globose, ochraceous tawny, dry, peeling, smooth polished, breaking up into large adnate scales

showing white flesh underneath; cuticle overlapping gills; margin incurved at first, reddish brown where rubbed, veil often appendiculate to margin. *Gills* crowded, broadly linear up to 2 cm. of several lengths, free, remote, fragile, thin, greyish white changing to brown (Wood Brown: Ridgway) and finally black; edge eroded. *Stem* 7–16 cm. long, 5–6 cm. thick, often ventricose, hard, stout, solid, white, striate above, reddish brown below and usually adorned with several concentric rings adpressed to the stem which disappear with age. *Flesh* white, unchangeable. *Taste* mild, nutty. *Smell* faint of mushroom. *Spores* in mass brownish black; under microscope dark brown, elliptic $7-8 \times 5-5\frac{1}{2}\mu$ smooth. *Basidia* 4-spored. *Cystidia* gill edge sterile with globose or pyriform cells 10–12 μ wide. Specimen No. 58.

Psalliota nobilis Pearson, sp.nov. Copiose ad terram sub *Pinus radiata*. Tokai Forest, Junio 1948. *Pileus* valde carnosus usque ad 24 cm. latus, semi-globosus, ochraceo-fulvidus tactu brunneo-rufescens, in squamas adpressatas ruptus, carnem albidam infra detegens; cute secernibili, lamellas superanti; margine primitus incurvato, velo saepe appendiculato. *Lamellae* confertae, late lineares usque 2 cm. inaequales, liberae, remotae, fragiles, tenues, albo-griseae dein griseo-brunneolae, denique nigrae; acie erosa. *Stipes* 7–16 cm. longus, 5–6 cm. crassus, saepe ventricosus, basi attenuatus, sursum albus striato-fibrillosus, deorsum pluribus annulis adpressatis concentricis rufo-brunneis, vetustate evanescentibus ornatus. *Caro* alba, immutabilis. *Sapor* dulcis. *Odor* dilute funginus. *Sporae* in cumulo fusco-nigrae; sub microscopo obscure-brunneae; ellipticae $7-8 \times 5-5\frac{1}{2}\mu$ laeves. *Basidia* tetraspora. *Cystidia* in acie lamellarum subglobosa 10–12 μ lata.

***Psalliota albo-argillascens* n.sp.**

HABITAT: gregarious in grass on roadside under oak trees, Mowbray; collected by Mr S. Garside, May 1948.

Cap 6–12 cm., fleshy convex with flat centre then expanded and depressed, chalk white, clay brown where rubbed, peels, smooth, mat, innately fibrillose, shaggy near margin, which is incurved at first, regular or wavy, smooth and opaque. *Gills* crowded, linear, pointed both ends, narrow (4–7 mm.) free, near stem, many lengths, tender, thin, at first pink, finally brownish black, edge smooth. *Stem* 6–10 cm. cylindrical, base abruptly bulbous with clearly marked ridged margin, firm, solid then hollow, striately fibrillose, white, clay brown to touch. *Ring* membranous, thin, white, single, sheathed above and pendulous. *Flesh* white, over gills a horny line. *Taste* mild. *Smell* pleasant of mushrooms. *Spores* in mass brownish black; under microscope brown translucent; ovoid $5-6 \times 3\frac{1}{2}\mu$, 1-guttulate, smooth. *Basidia* 4-spored. *Cystidia* none; gill edge fertile. *Cap surface* with septate hyphae 5–6 μ diameter. Specimen No. 45.

Psalliota albo-argillascens Pearson, sp.nov. Gregatim in graminosis juxta vias sub quercu. Mowbray, Autumno 1948. *Pileus* 6–12 cm. carnosus, convexus centro plano dein expanso-depressus, cretaceo-albus, tactu argillascens, laevis, impolitus, innate fibrillosus, prope marginem villosus; cute secernibili; margine regulari vel undulato, laevi, opaco, primitus incurvato. *Lamellae* confertae, lineares, utrinque attenuatae, angustae, liberae approximatae, teneres, tenues, primo rubellae denique fusco-nigrae. *Stipes* 6–10 cm. teres basi bulbo abrupte marginato, firmus, solidus dein cavus, striato-fibrillosus, pileo concolor. *Annulus* membranaceus, tenuis, simplex, amplus, pendulus, superus, persistens. *Caro* alba, immutabilis. *Sapor* mitis. *Odor* grate funginus. *Sporae* in cumulo brunneo-nigrae; sub microscopo, pellucido-brunneolae, ovoideae $5-6 \times 3\frac{1}{2}\mu$ 1 guttulae, laeves. *Acies* lamellarum fertilis absque cystidiis.

Psalliota mixta n.sp.

HABITAT: in sandy ground solitary or a few together, Pinelands. Collected by Miss Venning, June-July 1948.

Cap 6-12 cm., fleshy, semi-globate, dark brown with violaceous tints, dark lilaceous when old, with radiating fibrils and adpressed scales especially near margin which is incurved at first, often with a white narrow remnant of the veil adhering to the edge. *Gills* crowded then subdistant, ventricose or linear, mostly one length, free, near stem, thin, white at first then brownish black with fimbriate edge. *Stem* 6-14 cm. long, 4-5 cm. thick, cylindrical ventricose or clavate, robust, white, minutely fibrillose. *Ring* sheathed above and pendulous, single, white striate silky above, rather shaggy underneath. *Flesh* thick, turns slightly brown in cap, and pallid salmon in stem. *Taste* mild, rather rancid. *Smell* none. *Spores* in mass brownish black (Bone Brown; Ridgway), broadly elliptical $7-7\frac{1}{2} \times 5-5\frac{1}{2} \mu$ smooth. *Basidia* 4-spored. *Cystidia* on gill edge subglobose 12-16 μ broad. Specimen No. 68.

Psalliota mixta Pearson, sp.nov. Ad terram arenosam solitaria vel gregatim. Pinelands, Junio-Julio 1948. *Pileus* 6-12 cm. carnosus, convexo-pulvinatus obscure brunneus sed purpureo-tinctus, vetustate obscure lilacinus, fibrilloso-rimosus, squamulis adnatis praecipue prope marginem; fragmentis veli albidis angustis ad marginem saepe adhaerentibus. *Lamellae* primo confertae dein subdistantes, lineares vel ventricosae plerumque aequales, liberae, albae demum fusco-nigrae, acie fimbriata. *Stipes* 6-14 cm. longus, 4-5 cm. crassus, cylindricus, ventricosus vel clavatus, albus, subtiliter fibrillosus. *Annulus* membranaceus superus, pendulus, amplus, simplex, albus supra sericeo-striatus, infra floccosus. *Caro* alba dein in pileo dilute brunneola, in stipite pallide salmonea. *Sapor* mitis dein aliquantulum rancidus. *Odor* sub-nullus. *Sporae* in cumulo fusco-nigrae; late ellipsoideae $7-7\frac{1}{2} \times 5-5\frac{1}{2} \mu$ laeves. *Basidia* tetraspora. *Cystidia* in acie lamellarum subglobosa 12-16 μ lata.

Psalliota volvata n.sp. (Pl. 17)

HABITAT: on sandy ground under an open shed in garden at Rondebosch, C.P., 13 June 1948, where larger specimens had been collected by Miss Edith L. Stephens in November 1947.

Cap fleshy, 7-10 cm., convex then flat, white with violaceous or pinkish tinge, dry, smooth; cuticle tough and about 2 mm. thick, overlapping gills and peeling. *Gills* crowded at first, subdistant when cap fully expanded, linear or ventricose, free, fragile, thin, white at first, then brownish and finally black. *Stem* central, short and stout at first, up to 10 cm. long and 2-2 $\frac{1}{2}$ cm. thick when fully extended, equal, base attenuated, fibrillose, white. *Veil* thick, splitting about 5 mm. outside margin and forming a peronate sheath which shrinks and widens till it becomes a cup-shaped widely open volva at the base of the stem. *Flesh* white, quickly turning blood red and later a dingy brown. *Taste* mild. *Smell* pleasant of mushroom. *Spores* in mass brownish black; under microscope dark brown; broadly oval or subglobose $7-8 \times 6-6\frac{1}{2} \mu$ (a few larger $9-10 \times 6-6\frac{1}{2} \mu$), smooth with short hyaline apiculus. *Basidia* elongate-clavate, 40-50 $\times$ 10 μ , 2- or 4-spored. *Cheilocystidia* clavate with stem 40 μ long, 4-5 μ wide, and swollen apex. Specimen No. 69.

If *Clarkeinda* O. Kuntze (= *Chitonina* Fr. non Moc. & Sessé) is adopted as a separate genus, this well-marked volvate mushroom would be qualified for inclusion.

Psalliota volvata Pearson, sp.nov. Ad terram arenosam sub taberna aperta in horto, Rondebosch, 13 Junio 1948, quo loco prius (November 1947) adfuerant specimines majores. *Pileus* carnosus 7–10 cm. latus, convexo-applanatus, albus, violaceo vel roseolo tinctus, siccus, pellicula lenta, circa 2 mm. crassa, secernibili, lamellas superanti. *Lamellae* primo confertae, dein subdistantes, lineares vel ventricosae, liberae, fragiles, tenues, albae dein brunneolae et tandem nigrae. *Stipes* centralis, primo brevis et obesus, dein usque ad 10 cm. longus, 2–2½ cm. crassus, aequalis basi attenuato, fibrillosus, albus. *Velum* crassum, extra marginem circa 5 mm. scindens, vaginam peronatam formans et tandem ad basim stipitis volvam caliciformam apertam relinquens. *Caro* alba, fracta statim sanguinea, demum brunnescens. *Sapor* dulcis. *Odor* grate funginus. *Sporae* in massa brunneolo-nigrae, sub microscopo obscure brunneae, late ovatae vel subglobosae 7–8 × 6–6½ μ (perpaucae majores 9–10 × 6–6½ μ) laeves, apiculo hyalino praeditae. *Basidia* clavata, 40–50 × 10 μ bispora et tetraspora. *Cheilocystidia* clavata stipite circa 40 μ longa, 4–5 μ lata, apice inflata. *Cutis pilei* hyphis 5–5½ μ diametro hyalinis vel leviter flave tinctis composita.

Coprinus agricola n.sp.

HABITAT: edge of field at Hohenort Woods, Constantia, in troops, some caespitose. 5 June 1948.

Cap about 1 cm. before expanding, 4–5 cm. when expanded, conical then flat, buff brown darker in centre at first, then greyish black with brown centre, somewhat glistening, striate to smooth disk. *Gills* crowded then subdistant, linear, narrow, adnexed, thin edge eroded, all equal, white at first then black. *Stem* 4–6 cm. long, 2–3 mm. thick, equal or base slightly swollen, white, fragile, hollow, naked, polished. *Flesh* very thin, buff; no smell or taste. *Spores* under microscope in water dark brown, in KOH dark violet, elliptical truncate 11–12 × 6–7 μ, smooth, with germinative spore. *Cystidia* on gill edge broadly clavate or pyriform; props on gill face 75–100 × 20–30 μ. *Cap surface* globose or pyriform cells 15–25 μ wide. Specimen No. 61.

Coprinus agricola Pearson, sp.nov. Prope viam in terra culta, catervatim. Hohenort C.P., Junio 1948. *Pileus* membranaceus ex conico expansus 4–5 cm. latus, pallido-brunneus, centro obscuriori dein griseo-niger centro brunneo, sub-nitens, striatus disco laevi. *Lamellae* confertae dein subdistantes, lineares, angustae, adnexae, tenues, aequales, albae demum nigrae. *Stipes* 4–6 cm. longus, 2–3 mm. crassus, aequalis, basi leviter inflatus fragilis, fistulosus, albus, nudus, politus. *Caro* tenuissima, pallido-luteola, insapora et inodora. *Sporae* sub microscopo: in aqua obscuro-brunneae, in KOH obscuro-violaceae, ellipsoideae truncatae 11–12 × 6–7 μ laeves, poro germinativo conspicuo. *Cheilocystidia* piriformia; *pleurocystidia* cylindrica 75–100 × 20–30 μ. *Cutis pilei* e cellulis piriformis vel globosis 15–25 μ latis composita.

Boletus

All the Boleti collected were well-known European species. Three species collected in the area under review have previously been described as new. These are: *Boletus subflammeus* Berk. (1876); *B. curtipes* Massee (1908); *B. stellenbossiensis* v.d. Byl. (1925). The type specimen of the first is at Kew, and proved to be *B. piperatus* with a shorter stem than usual.

A specimen of *B. curtipes* is also at Kew. Its chief feature is the thick cuticle of the brown pileus with deep coarse cracks, the surface being broken into rather large irregular patches. The spores of this specimen are subfusoid, 13–14 × 4–4½ μ, the same as found in *B. edulis* and many other species.

The cracked pileus corresponds to that described for *B. stellenbossiensis*. The spores of the latter species were recorded as oblong-elliptic, with rounded ends 20 × 6–9 μ, but examination of a specimen preserved at

Stellenbosch University discloses that the spores are the typical boletoid subfusoid spores with one rounded end and the other with an oblique apiculus, and measuring $14-17 \times 4-5 \mu$ with a few larger. Probably it is the same as *B. curtipes* and both may only be sun-dried *B. edulis*.

Boletus bellinii Inzenga (*Funghi Siciliani* II, 25, 1861) = *Ixocomus bellinii* (Inz.) R. Maire = *B. circinans leptopus* Persoon *Myc. Eur.* 1825.

HABITAT: on ground under *Pinus pinaster* April-July; everywhere in Cape District. Common late in the season.

Cap 3-8 cm., semi-globate, ivory white, soon covered with dark umber brown gluten, usually leaving a narrow white margin, shining when dry. Tubes short, yellow. Pores darker, small and close, exuding a white milky liquid when young. Stem short and sturdy often pointed at base, yellowish with reddish or chocolate coloured granules at the apex. Flesh white with slight lemon tint. Taste mild. Smell pleasant. Spore powder clay colour.

Spores pale yellow, translucent under microscope, cylindrical subfusoid $8-10 \times 3-3\frac{1}{2} \mu$ smooth, slightly oblique one end.

The above is a description of the Cape form of this species. By some authors it is considered as a variety of *B. placidus* which is a more slender species with an ivory white cap which does not change colour as it matures.

The epithet *leptopus* would be preferable, but Persoon's name does not conform to the International Rules: it is part of a trinomial associated with *B. circinans* which is a synonym of *B. granulatus*.

This *Boletus* was named after Vincenzo Bellini, the famous opera composer.

Boletus bovinus (Linn.) Fr. var. **virido-caerulescens** n.var.

Differs from type in the golden yellow flesh which slowly turns dark or light greenish blue in cap.

A typo differt carne aureo-flavida, in pileo secta tarde obscure vel pallide virido-caerulescens.

This variety of the common *B. bovinus* was growing under *Pinus radiata* in the Elgin Woods, C.P., 22 June 1948. Specimen No. 73.

Boletus duriusculus Schulzer

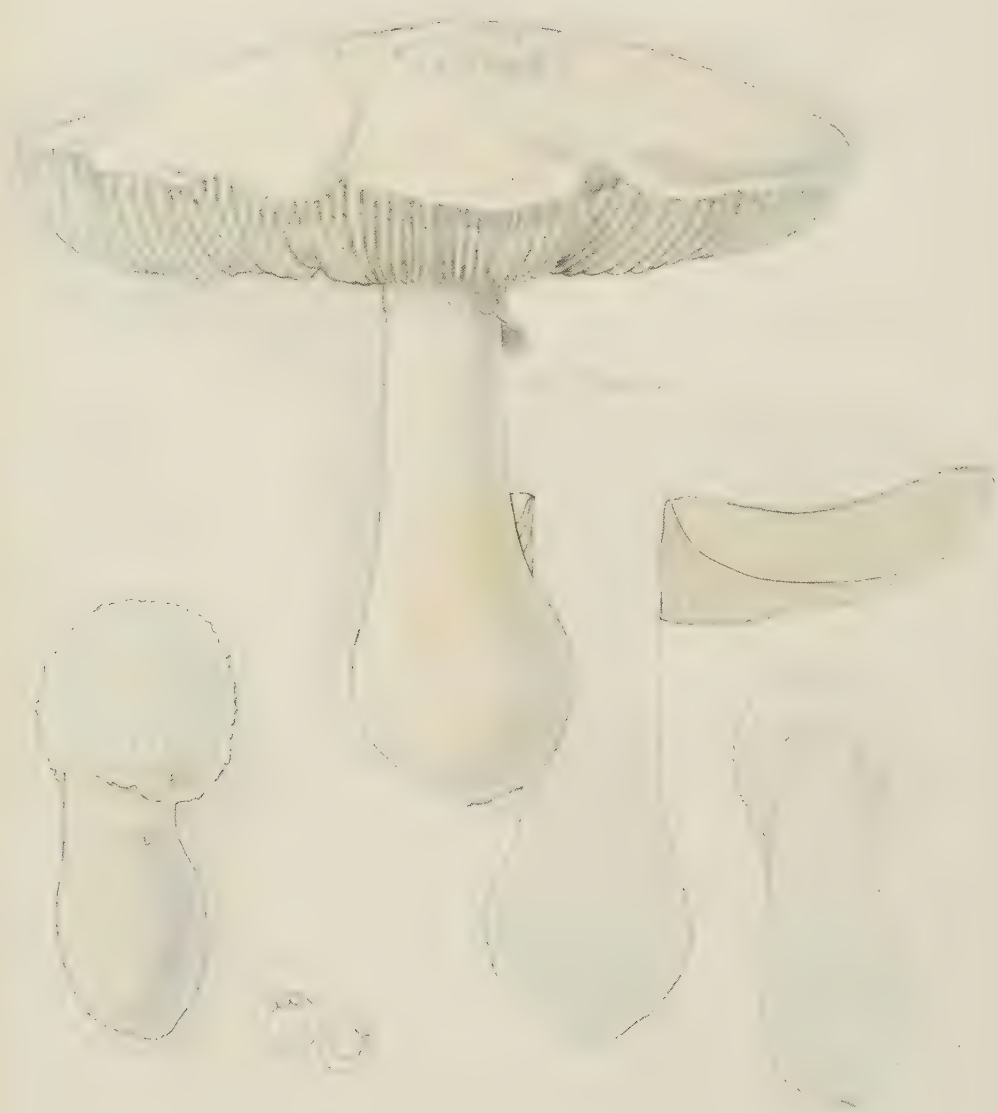
HABITAT: in troops on ground under *Populus canescens*. Common.

Cap 4-30 cm., fleshy, somewhat viscid, semi-globate or slightly gibbous, varies from pure white to pale pinkish buff, cinnamon buff and bistre (all Ridgway colours), peels with difficulty, densely tomentose sublente, often rugulose, fine close cracks appearing in many if not most mature specimens; margin incurved at first, cuticle overlapping tubes, regular, smooth. Tubes easily separable, adnexed, outline in section wedge-shaped, short or long. Pores small and round, at first white or creamy white, olive greenish to touch, later greyish drab turning olive brown when rubbed. Stem 10-20 cm. long, 3-5 cm. thick, equal or ventricose, hard, solid, rather sticky, white with striate granular blackish raised subreticulate lines; bluish green at base. Flesh white; in cap turning pale pink and then mottled purplish black; in stem changing to a dingy green, then blackish above and brilliant bright bluish green below. Taste mild. Smell pleasant. Chemical reaction FeSO_4



Lepiota zeyheri Berk.. Much reduced in size. Spores $\times 600$.

Mary Maytham pinxit



Lepiota praeclara Pearson. Spores $\times 1000$

Mary Maytham pinxit



Lepiota roseolens Pearson. Spores $\times 1400$

Mary Maytham pinxit

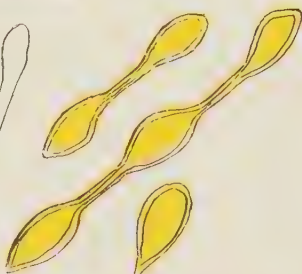


Lepiota truncata Pearson.
Spores $\times 1000$; cystidia $\times 400$



Lepiota canescens Pearson. Spores $\times 1000$; cystidia $\times 600$

Mary Maytham pinxit



Collybia chrysophepla (Berk & Curt.) Pearson.
Spores $\times 1000$; cystidia $\times 400$.



Psalliota volvata Pearson.
Mature sporophore



Lepiota cutifracta Pearson. Spores $\times 1000$



Russula capensis Pearson. Spores $\times 1500$

Mary Maytham pinxit



Psalliota nobilis Pearson



green. *Spore powder* brownish olive (Medal Bronze: Ridgway) in fresh deposit, later changing to snuff brown. *Spores* obliquely spindle-shaped or fusoid, $12-15 \times 5 \mu$, smooth. *Cystidia* on tubes lanceolate, hyaline, acute $8-10 \mu$ wide with thin walls. *Cap surface* with septate hyaline hyphae $5-8 \mu$ wide, mixed with brown hyphae when cap is coloured. *Stem surface* scales of stem made up of parallel septate hyphae about 6μ diameter with clavate ends $8-10 \mu$ wide.

The above describes the form of this boletus as found in the south-west corner of the Cape Province, often in great abundance. It differs from the type only in the varied colouring of the cap, including a pure white form which, however, is so often mixed with other colour forms, that they probably arise from the same mycelium. Specimen No. 38.

Although the object in making this survey was to record the gilled fungi and the boleti, a very brief note on the other groups of the larger fungi may be given. Most of the species that met the eye as we wandered through the woods and over the beautiful hilly country were much the same as we see in northern Europe. Occasional bright patches of the scarlet *Trametes cinnabarina* (Jacq.) Fr. or a group of the small delicate orange coloured *Laschia thwaitesii* B. & Br. (*Favolaschia thwaitesii* (B. & Br.) Singer), would remind us that we were in a warmer climate. Most of the fungi were familiar species and, though the number was small, they were often in dense clusters. Here is a short list of the common ones:

Polyporus sulphureus and *adustus*
Ganoderma applanatum
Daedalea quercina (often gigantic in size)
Lenzites betulina (but not on birch)
Polystictus versicolor
Stereum hirsutum

Resupinates were not so common as in the English woods, but there were large patches of *Coniophorella olivacea* on stumps and a near relative of *Merulius lachrymans* on the banks in pine woods. Unfamiliar species of *Auricularia* and *Exidia* frequently occurred. Clavarias were rare.

The commonest of the puff-balls was *Pisolithus tinctorius* which seemed to be under every Eucalyptus tree, pushing its snake-like epiderm out of the sandy soil. Many species of *Lycoperdon* were seen and a few Geasters. *Rhizopogon rubescens* was fairly common.

The phalloids, which are a well-known feature of the South African fungus flora, were not so frequent as I expected. Under oaks we often came across *Anthurus archeri* with its brilliant scarlet tongues. *Clathrus gracilis*, which has a white cage-like receptacle, appeared in the Kirstenbosch Gardens. *Dictyophora indusiata* was only seen once in the woods looking very like the common stinkhorn, its delicate lace-like cape having collapsed, and *Phallus imperialis* turned up on two occasions in private gardens.

I have to thank very warmly all those who have assisted me in the preparation of this paper: for generous private hospitality, for transport to the collecting grounds, for a substantial grant from the Royal Society and

for the help of those distinguished mycologists to whom many critical species were submitted; these include Mr Alexander H. Smith of Michigan University, Dr Rolf Singer of the Farlow Herbarium, Harvard, Prof. J. B. Cleland of Adelaide University, Messieurs E. J. Gilbert, H. Romagnesi, M. Locquin and R. Henry of France, Dr Albert Pilát and Mr V. Melzer of Czechoslovakia, Mr F. H. Møller of Denmark; also to Miss E. M. Wakefield and Dr R. W. G. Dennis, to whom I am indebted in many ways; to the former especially for correcting my Latin diagnoses and the latter for help in exploring the literature and the exsiccata in the Kew Herbarium. The list of books referred to is too long for citation. It is hardly possible to make a complete survey of the vast and ever increasing number of fungus species described in books and periodicals published in various parts of the world. I can only hope that among the list of species described as new, there will be found few (if any) that have been recorded elsewhere under other names.

(Accepted for publication 5 November 1949)

A FRUIT ROT OF PAPAYA (*CARICA PAPAYA* L.) CAUSED BY *ASCOCHYTA CARICAE* PAT.

By S. CHOWDHURY, *Mycologist, Assam, Jorhat, India*

(With Plate 20 and 1 Text-figure)

A rot of papaya (*Carica papaya* L.) fruits due to *Ascochyta caricae* Pat. is very serious and widespread in almost all the major papaya-growing tracts of Assam. It was first observed in the Burnihat Fruit Research Station during July 1944, and has since recurred there every year in a severe form during the rains. A survey revealed its occurrence in the different papaya-growing localities of Cachar district and in the North Cachar Hills where the fruit is cultivated to a considerable extent: 10–15 % of the fruits were affected on the trees.

So far no rot of papaya fruits due to *A. caricae* has been reported from any part of India (Butler & Bisby, 1931; Uppal, Patel & Kamat, 1935; Mundkur, 1938), but a fruit rot due to this fungus has been reported from Queensland by Simmonds (1934, 1937, 1940) and Da Costa (1944), and from Kenya by Natrass (1941). It has also been reported from Rhodesia by Hopkins (1938), who first named the parasite *Phoma caricina* n.sp. but later (Hopkins, 1943) corrected his earlier diagnosis and ascribed the trouble to *Ascochyta caricae*, and Goncalves-Silva (1941) has reported a leaf spot of papaya due to *Ascochyta* sp. from Brazil, but no leaf disease of papaya due to *Ascochyta* has been noticed in Assam, Queensland, Kenya or Rhodesia.

SYMPTOMS

The disease is usually seen on half-grown, mature or ripe fruits, first as small, circular water-soaked spots one-eighth to one-half inch across. The lesion slowly enlarges and after about 5–8 days, depending on the prevailing weather conditions (temperature and humidity), it may be as much as 3 in. in diameter, sunken and brownish black in colour. The rot usually spreads irregularly or roughly centrifugally, and the black colour serves to distinguish the disease from Anthracnose. Numerous pycnidia, clearly visible through a hand lens, appear in the black area and later the lesion becomes considerably depressed, jet black, tough, and wholly occupied by partially erumpent pycnidia.

The spots tend to occur in groups on the upper side of the fruit, or at the bottom end, and in advanced stages they may coalesce until a large part of the fruit surface is affected. Usually a number of spots are formed on a fruit which becomes almost entirely affected (Pl. 20). Although the disease normally occurs in the field it may also develop in a serious form in harvested fruits.

MORPHOLOGY ON THE HOST

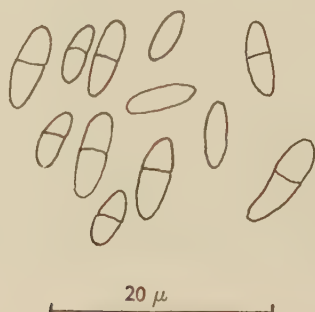
Mycelium. The mycelium permeates the entire rotted area, extends slightly into the surrounding area, and penetrates deeply into the substance

of the fruit. The young hyphae are hyaline, sparsely septate and slender while the older hyphae are broader, thick, more frequently septate, irregularly branched and coloured.

Pycnidia. The pycnidia formed on the spotted fruit are at first submerged, later becoming erumpent but never superficial, and measure $85-218 \times 65-192 \mu$ (average $130 \times 114 \mu$). They are spherical, black carbonaceous with distinct ostioles.

In section the pycnidial wall is thin below, consisting of one or two layers of dark-coloured stroma, and much thicker at the top; after the formation of the ostiole the thickened wall persists around the short neck. Next to the inside of the wall are the narrow sporogenous layers of hyaline parenchyma cells bearing the conidiophores.

Conidiophores. The conidiophores arise from a hyaline sporogenous layer of cells which is supported by a colourless pseudo-parenchymatous sheath lining the dark wall of the pycnidium. The sporogenous layer is composed of very small and narrow cells from which the conidiophores arise. The conidiophores are simple, short and unicellular.



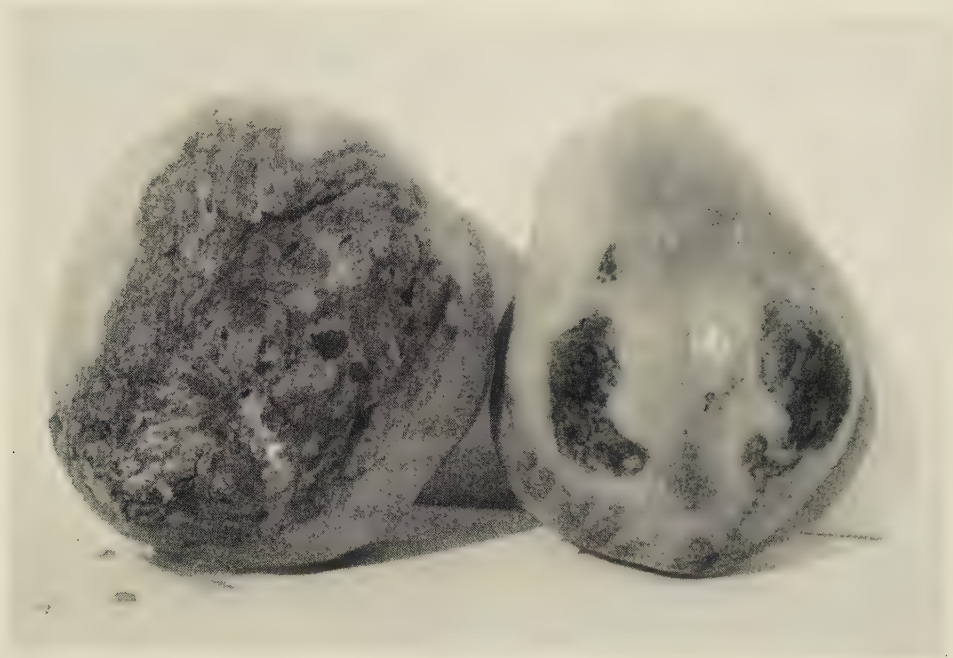
Text-fig. 1. Pycnospores of *Ascochyta caricae*.

Pycnospores. The pycnospores are extruded in long coiled tendrils through the ostiole. They are hyaline, ovoid, ellipsoid, mostly bi-cellular, with one cell often larger than the other, and measure $7-12 \times 3-4 \mu$ (Text-Fig. 1). A few single-celled spores were also noticed: a count of 500 spores at random showed 95 % one-septate and 5 % non-septate.

ISOLATION AND INOCULATION EXPERIMENTS

Isolation. The fungus was readily brought into culture by transferring surface-sterilized pieces of affected fruits to oat agar plates. Single-spore cultures were also taken from carefully selected pycnidia. A large number of isolations was made by both methods and all yielded the same fungus.

Inoculation experiments. Many inoculation experiments were carried out with pure cultures of the fungus both in the laboratory and in the field. In the laboratory they were carried out on healthy half mature, mature and ripe fruits plucked from plants. The fruits were surface sterilized and bits of culture containing mycelium and crushed pycnidia of the fungus, or only the spores of the fungus obtained by crushing pycnidia, were placed



Two papaya fruits showing rotting due to *Ascochyta caricae* Pat.

on the wounded and unwounded surfaces of the fruits. Before inoculating the fruits with conidia, circles of petroleum jelly were painted on the surface of the fruit and small drops of a spore suspension of conidia, obtained by crushing the pycnidia of the fungus in sterile water, were placed on the portions of the fruit surface thus enclosed. The inoculated fruits were then placed in a sterile moist chamber at room temperature (27–30° C.). Wounding was done by gently pricking the surface with a sterile needle. On the second day infection was visible on wounded fruits, and on the fourth day the rot was definitely established. On the uninjured fruits signs of infection were visible on the fourth or fifth day. On the sixth day the fruits were removed from the moist chamber and kept under ordinary conditions in the laboratory. The rot gradually developed and finally showed the typical symptoms. The entire fruit mostly rotted within 12 days and pycnidia developed on the surface. Out of 127 inoculations 121 were successful, while all the controls remained healthy.

Similar infection experiments were carried out in the field. Fruits were selected, surface-sterilized and inoculated at selected places on the surface. The inocula were then covered with small pieces of sterile absorbent cotton made wet by dipping in sterile water, and the fruits were bagged with tissue paper. Twice each day the inoculated fruits were sprayed with sterile water after removing the bag, and then again bagged. In all the inoculated fruits signs of infection were apparent after 5–6 days; the bags were then removed and the fruits exposed to natural conditions. Henceforward infection spread and typical rot symptoms developed in the course of 10–12 days. Controls were kept and all of them remained healthy.

From the artificially inoculated fruits the fungus was recovered by re-isolation.

EFFECT OF TEMPERATURE AND HUMIDITY ON THE DEVELOPMENT OF THE ROT

Under field conditions the rot is very much influenced by the prevailing climatic conditions. Experiments were therefore conducted under controlled conditions to see the effect of temperature and humidity on its development.

Table 1. *Effect of temperature on papaya fruit rot due to Ascochyta caricae*

Temperature (° C.)	Percentage area of papaya fruits destroyed by rot. Average of ten fruits kept at each temperature
20	41.0
25	62.4
30	72.9
35	37.6

Effect of temperature. This was studied by placing a number of inoculated fruits in moist chambers kept in incubators maintained at different constant temperatures. Each fruit was inoculated at a single central place and the development of the rot was determined by measuring the rotted area after

10 days and calculating the percentage of fruit area destroyed. Five fruits were kept at each temperature and the experiment was repeated. The method of inoculation consisted in placing pieces of culture medium containing the mycelium and crushed pycnidia of the fungus at the selected places. The effect of temperature on the percentage area of rotting of green fruits is shown in Table 1. Up to 30° C. the higher the temperature the greater the percentage area of the fruit destroyed by rotting; at 35° C., however, there was less rot.

Effect of humidity. The inoculated fruits were kept in constant humidity chambers for 10 days, after which the progress of the rot was measured and the percentage of fruit area destroyed determined. Constant humidities were obtained by the use of sulphuric acid solutions of different concentrations (Stevens, 1916). Five inoculated fruits were maintained at each humidity and the experiment was repeated. Pieces of culture medium containing mycelium and crushed pycnidia of the fungus were placed at a single selected place on each fruit. The results, which are given in Table 2, show that the higher the relative humidity the greater the area destroyed by rotting.

Table 2. *Effect of humidity on papaya fruit rot due to Ascochyta caricae*

Humidity	Percentage area of papaya fruits destroyed by rot.
	Average of ten fruits at each R.H.
100	72.4
91.2	62.6
70.4	56.7
60.7	36.3
49.0	22.0

GROWTH IN CULTURE

The fungus was grown on oat, maize, potato dextrose and Dox agars. Mycelial growth was good on all these media, but better on oat and maize agars than on the others. Aerial growth was scanty; much of the mycelium was submerged and spreading.

The mycelium consists of septate, subhyaline hyphae which branch irregularly. The young hyphae are long, slender; septa are rare and the walls are not constricted. In the old hyphae the cells are short, thick, and occupied by large globules of a greenish colour; septation is frequent and the walls are prominently constricted at the septa.

In culture pycnidial formation starts on the fifth or sixth day. The pycnidia are spherical, black, ostiolate and measure 90–220 × 70–190 μ . In size, shape and colour the pycnidia formed in the different media agree very closely. The pycnosporos are liberated through the ostiole in long, pinkish coiled tendrils. They are hyaline, ovoid, ellipsoid, and measure 7–12 × 3–4 μ : 96 % (random counting of 500 spores) were one-septate. In size, shape, colour and septation they were alike in the different media, and agreed very closely with those formed on the host in nature.

CONTROL

A few experiments were carried out to devise methods of control. Young, half-mature, mature and ripe fruits were sprayed with Bordeaux mixture 2:2:50 to which potash soft soap at the rate of 2 lb. per 40 gallons of spray fluid was added as a spreader, in order to obtain a good cover on the waxy surface of the papaya fruits.

A plantation where the disease had been known to occur every year was selected for the purpose. One hundred plants with their fruits at different stages of development were selected and divided into five lots, each lot containing twenty plants. These five lots were then sprayed respectively at intervals of 15, 21, 30, 45 or 60 days. A sixth lot of twenty plants, kept to serve as control, were not sprayed. Regular records of rotting were kept and it was found that spraying appreciably reduced the percentage of rot. These trials further brought out the facts that in spraying to control fruit rot it is essential to keep the young fruit covered with a fungicide from the time of setting, and that spraying should be done at intervals of 21–30 days. If this is done effective control may be obtained.

SUMMARY

A rot of papaya fruits caused by *Ascochyta caricae* has been observed in the papaya-growing tracts of Assam. The symptoms of the disease and the morphology of the parasite on the host are described. The pathogenicity of the fungus was established by inoculation experiments carried out with pure cultures on wounded and unwounded fruits. The rot is influenced by temperature and humidity: and is most severe at 30° C. and at 100 % R.H.

The fungus was grown in oat, maize, potato dextrose and Dox agars, and its growth characteristics studied. Size, shape and colour of both pycnidia and pycnospores were found to be practically the same in all the media and they agreed with those formed in nature.

Experiments showed that the disease can be controlled by spraying the fruits with 2:2:50 Bordeaux mixture at intervals of 21–30 days. In order to get good control it was found necessary to keep the fruits thoroughly covered with the fungicide from the time of setting.

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THE SWELLING OF MOULD SPORES IN THE PRESENCE OF HYDROXY COMPOUNDS

By BERNARD VERDCOURT, *Amani, Tanganyika*

Dr P. W. Brian (1949) has commented on the observation made by Armitage and Verdcourt (1948), that sodium pentachlorophenate at certain concentrations induces the spores of *Aspergillus niger* Van Tieghem to swell into 'giant cells'. I have observed this effect with other compounds and it may be of interest to note these. Spores of *A. niger* were incubated at 26° C. on Czapek-Dox agar plates containing various compounds, and the 'giant cell' effect was observed with the following (critical concentrations in p.p.m. are given in brackets). They are listed in decreasing order with respect to the magnitude of the effect they cause as measured by the size of the cells obtained: β -naphthol (80); thymol (180); phenol (750); sodium *o*-phenyl-phenate (100); *s*-tribromophenol (10); 2:4-dichlorophenol (50); and ethyl alcohol (7×10^4). The effect has not been observed with phenols substituted with one or more nitro groups, or with an additional hydroxyl group. It has not been noted with any nonhydroxylic compounds. The giant cells obtained show morphological differences depending on the compound used.

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THE NUMBERS OF NUCLEI IN CONIDIA OF ASPERGILLI

By EDWARD YUILL, *Acomb, York*

(With Plate 21)

In the course of studies on heterokaryosis in *Aspergillus* species made by Gossop, Yuill & Yuill (1939), it soon became apparent that some of the results observed could not be explained without knowing whether the conidia of the moulds being investigated had one or more nuclei. For example, mixed cultures of one of the pairs of moulds tested, gave heterokaryotic heads with conidia of one colour only. This suggested that the conidia themselves might be heterokaryotic. In another pair, the heterokaryotic heads clearly showed conidial chains of two colours. In this instance it is unnecessary to assume the conidia had more than one nucleus each. A search of the literature showed that information of the kind required had been published only for a small proportion of the *Aspergilli*. I therefore examined the several species concerned and their mutants, and determined the number of their conidial nuclei. As it was thought probable that a list giving the number of nuclei in *Aspergillus* conidia would be useful for reference by other workers, examination of all the readily obtainable species was continued. The results are given in Table 1. Though not complete, it includes the majority of the seventy-five species accepted by Thom & Raper in their *Manual of the Aspergilli* (1945). A few varieties and mutants are also included.

The species are arranged in the groups of Thom & Raper and follow the order given in the *Manual*. To show the relationship between spore size and number of nuclei, average values for the former, taken from the *Manual*, are given for each species. The table incorporates the names of all the species described by Thom & Raper, except five species not known to be in culture.

It should be noted that column 4 of the table usually gives data relating to one strain only, typical of each species; the figures for the number of nuclei are therefore not necessarily true of other and possibly less typical strains.

HISTORICAL

Previous investigations relating to the nuclei of the vegetative spores of *Aspergilli* include the following:

Dangeard (1907) reported on *A. fumigatus*, *A. nidulans*, *A. ochraceus*, *A. niger*, *A. flavus* and *Eurotium* [*Aspergillus*] *herbariorum*. He figured all except the last-named species as uninucleate.* Fraser & Chambers (1907) dealt with *A. herbariorum*, and Dale (1909) with *A. repens*. Wakayama (1931) examined thirteen *Aspergillus* species comprising: *A. albus* Wilh., *A. aureus*

* Species are frequently referred to as 'uni-' or 'multi-nucleate'. This abbreviation stands for 'species with uni- or multi-nucleate conidia'. Also, the term spore is occasionally used instead of conidium.

Table 1.

(Key to abbreviations used in column 2: A.=Culture Collection of John and E. Sturge (Citric) Ltd. A.T.C.C.=American Type Culture Collection. C.B.S.=Centraalbureau voor schimmelcultures, Baarn. I.M.I.=Culture Collection of the Commonwealth Mycological Institute, Kew. N.C.T.C.=National Collection of Type Cultures.)

	Source	Diameter of conidia in μ	Usual number of nuclei in conidia
<i>A. clavatus</i> group			
<i>A. clavatus</i> Desm.	N.C.T.C. 978	3.4 $\times$ 2.3	1
<i>A. giganteus</i> Wehmer	C.B.S.	3.5-4 $\times$ 2.4-3	1, occasionally 2 or 3
<i>A. glaucus</i> group			
<i>A. repens</i> (Corda) De Bary	N.C.T.C. 3905	5-6.5	1, 2, less frequently 3 or 4
	I.M.I. 16112		1, 2, less frequently 3 or 4
<i>A. pseudoglaucus</i> Bloch.	—	5.5-7.5	—
<i>A. ruber</i> (Spieck. & Brem.) Thom & Church	A. 27	5-6.5	1, 2
<i>A. proliferans</i> G. Smith	A. 8	5-9.5	1, 2
<i>A. chevalieri</i> (Mang.) Thom & Church	G. Smith	4.5-5.5	1
var. <i>intermedius</i> Thom & Raper	A. 42	3-4	1
<i>A. amstelodami</i> (Mang.) Thom & Church	D. Snow	3.5-5.2	1
<i>A. montevidensis</i> Talice & MacKinnon	A. 15	4.5 $\times$ 3-4	1
<i>A. mangani</i> Raper & Thom	—	6-8	—
<i>A. umbrosus</i> Bain. & Sart.	G. Smith	7-8	3, 4-6
<i>A. echinulatus</i> (Delacr.) Thom & Church	G. Smith	8-10	3, 5-10
<i>A. medius</i> Meiss.	G. Smith	8-10	3-5-10
<i>A. carnyi</i> (Biourge) Thom & Raper	—	8-10	—
<i>A. niveo-glaucus</i> Thom & Raper	G. Smith	6-8	1-5-12
<i>A. gracilis</i> Bainier	—	3	—
<i>A. conicus</i> Bloch.	—	Not mentioned	—
<i>A. restrictus</i> G. Smith	G. Smith	4.5-6 $\times$ 3-3.5	1
<i>A. penicilloides</i> Speg.	D. Snow	3.5-5 $\times$ 3.2-4	1
<i>A. itaconicus</i> Kinoshita	C.B.S.	4.3-5 $\times$ 3.5-4	1
<i>A. fumigatus</i> group			
<i>A. fumigatus</i> Fres.	A. 45	2.5-3	1
<i>A. fumigatus</i> mut. <i>helvola</i> E. Yuill	A. 64	2.5-3	1
<i>A. fischeri</i> Wehmer	A. 44	2.5-3	1
<i>A. malignus</i> Lindt	I.M.I. 16061	2.5-3	1
<i>A. nidulans</i> group			
<i>A. nidulans</i> (Eidam) Winter	A. 69	3-3.5	1
<i>A. nidulans</i> mut. <i>alba</i> E. Yuill	A. 70	3-3.5	1
<i>A. quadrilineatus</i> Thom & Raper	—	3-4	—
<i>A. rugulosus</i> Thom & Raper	—	3-4	—
<i>A. variegatus</i> (Berk. & Br.) Thom & Raper	—	3-4	—
<i>A. caespitosus</i> Raper & Thom	—	3.5-4.5	—
<i>A. unguis</i> (Emile-Weil & Gaudin) Thom & Raper	—	2.5-3.5	—
<i>A. ustus</i> group			
<i>A. ustus</i> (Bain.) Thom & Church	N.C.T.C. 3757	3.5-5	1
<i>A. granulosus</i> Raper & Thom	N.C.T.C. 6973	4.8-5.5	1
<i>A. flavipes</i> group			
<i>A. flavipes</i> (Bain. & Sart.) Thom & Church	N.C.T.C. 3890	2-3	1
<i>A. versicolor</i> group			
<i>A. sydowi</i> (Bain & Sart.) Thom & Church	N.C.T.C. 1944	2.5-3	1
<i>A. janus</i> Raper & Thom	N.C.T.C. 6970	(a) White 2-2.5 (b) Green 2.5-3.5	1 1
<i>A. versicolor</i> (Vuill.) Tiraboschi	D. Snow	2.5-3	1

	Source	Diameter of conidia in μ	Usual number of nuclei in conidia
<i>A. versicolor</i> group			
<i>A. humicolor</i> Chaudhuri & Sachar	—	2-3	—
<i>A. terreus</i> group			
<i>A. terreus</i> Thom	N.C.T.C. 981	1.8-2.4	1
<i>A. carneus</i> (v. Tiegh.) Bloch.	—	2.4-2.8	—
<i>A. niveus</i> Bloch.	—	2-2.5	—
<i>A. candidus</i> group			
<i>A. candidus</i> Link	A. 40	2.5-3.5	1
<i>A. niger</i> group			
<i>A. niger</i> van Tiegh.	N.C.T.C. 594	2.5-4	1
<i>A. foetidus</i> Raper & Thom syn. <i>A. aureus</i> Nakazawa	C.B.S.	Up to 4 or 4.5	1
<i>A. awamori</i> Nakazawa	N.C.T.C. 2044 C.B.S. (Nakazawa)	3-5	1, 2, occasionally 3 1
<i>A. miyakoensis</i> Nak., Simo & Wat.	—	3.7-5.6	—
<i>A. phoenicis</i> (Corda) Thom	—	not given	—
<i>A. pulverulentus</i> (McAlp.) Thom	N.C.T.C. 1324	4	1
<i>A. niger</i> mut. <i>cinnamomeus</i> (Sch.) Raper & Thom	C.B.S.	3-4	1
<i>A. niger</i> mut. <i>schiemanni</i> Raper & Thom	C.B.S.	3.5-4.5	1
<i>A. fumaricus</i> Wehmer	—	5, occasionally 7-8	—
<i>A. fonsecaeus</i> Raper & Thom	A. 56	5.5-8.5	2-5, sometimes 1 only
<i>A. carbonarius</i> (Bain.) Thom & Church	N.C.T.C. 1325	5.5-10.5	2-5, sometimes 1 only
<i>A. luchuensis</i> Inui	N.C.T.C. 3896	3.5-4	3, 4
<i>A. japonicus</i> Saito	N.C.T.C. 5604	4-5	1
<i>A. violaceo-fuscus</i> Gasperini	A. 34	3.5-5 $\times$ 5-6.5	1
<i>A. wentii</i> group			
<i>A. panamensis</i> Raper & Thom	N.C.T.C. 6974	2.2-2.6	1
<i>A. alliaceus</i> Thom & Church	A.T.C.C. 1024	2.5-3	1
<i>A. avenaceus</i> G. Smith	G. Smith	4-6 $\times$ 3.2-4	1, occasionally 2 or 3
<i>A. wentii</i> Wehmer	N.C.T.C. 5608	3.5-6	1
<i>A. tamarii</i> group			
<i>A. citrisporus</i> von Höhnelt	C.B.S.	5-9 $\times$ 5-6	4, 5
<i>A. lutescens</i> (Bain.) Thom & Church	—	5-8 $\times$ 7-9	—
<i>A. terricola</i> var. <i>americana</i> March.	A.T.C.C.	3.5 $\times$ 5-7	3, 4
<i>A. tamarii</i> Kita	A. 30	5-6.5	3, 4
<i>A. flavus-oryzae</i> group			
<i>A. oryzae</i> (Ahlburg) Cohn	A.T.C.C. 1011	3-5 $\times$ 4-6 or more	1-3
<i>A. micro-virido-citrinus</i> Cost. & Lucet.	—	3-4.6	—
<i>A. flavus</i> Link	N.C.T.C. 596	3, 3 $\times$ 4, 4 $\times$ 5 or more	1-3
<i>A. parasiticus</i> Speare	N.C.T.C. 975	4-5	3-4
<i>A. effusus</i> Tiraboschi	N.C.T.C. 973	3.5 $\times$ 4-7	2
<i>A. ochraceus</i> group			
<i>A. sulphureus</i> (Fres.) Thom & Church	C.B.S.	2-3.5	1
<i>A. quercinus</i> (Bain.) Thom & Church	N.C.T.C. 6979	2.5-3 $\times$ 3.5	1
<i>A. sclerotiorum</i> Huber	—	2-2.5	—
<i>A. melleus</i> Yukawa	C.B.S.	3 in long axis	1
<i>A. ochraceus</i> Wilhelm	A 4	3.5-5	1
<i>A. ostianus</i> Wehmer	N.C.T.C. 3788	3-4 or 5	1
<i>A. sparsus</i> Raper & Thom	N.C.T.C. 6975	3-3.5	1

Berk., *A. awamori* Nakazawa, *A. clavatus* Desm., *A. fumigatus* Fres., *A. giganteus* Weh., *A. glaucus* Link., *A. gymnosardae* Yukawa, *A. melleus* Yukawa, *A. niger* v. T., *A. ochraceus* Wilh., *A. ostianus* Wehmer, *A. varians* Wehmer. He found the sterigmata to be uni-nucleate in every case. More recently, Whelden (1940) has confirmed Wakayama's details for *A. niger*, and

Baker (1945) investigated *A. fumigatus*, *A. clavatus*, *A. repens* and *A. echinulatus*. The first three species were described as uni-nucleate, and the last, multi-nucleate.

When the specific name suffices to identify the mould reported on, it will be found that the foregoing results agree with those given in Table 1 except for Dangeard's *A. flavus* and Dale's *A. repens*. With species of the *A. glaucus* group it is not possible at this date to be sure just what moulds the earlier workers were dealing with. Even Dale's *A. repens* may have differed from the mould regarded as typical to-day. Baker (1945) found her strain of *A. repens* to be uni-nucleate, whereas Dale found up to twelve nuclei in the conidia of the strain she investigated. The conidia of the two strains of *A. repens* reported on in the present paper have mainly one or two, less frequently three or four, nuclei each. Wakayama's *A. glaucus* was evidently a species of the small-spored section of this group. His *A. albus* is now included in *A. candidus* Link, while *A. varians* is probably synonymous with *A. itaconicus*.

METHODS USED IN SPORE STAINING

Cultures to provide material for staining were grown on squares of sterile 'Cellophane' on Czapek or malt agar in Petri dishes. The 'Cellophane' was inoculated by drawing a loop of spores across the surface, in lines about half an inch apart. The plates were incubated at 28 or 22° C. When the culture had reached the sporing stage, but before pigmentation had begun, the 'Cellophane' was removed, cut into pieces, each with a strip of mould growth, and fixed in La Cour's 2 B.D. or in Allen's Bouin solution. After being fixed and washed, small pieces of the culture were teased out on a microscope slide, everything except conidiophores and conidia being discarded. A fair proportion of the heads were squashed with a small scalpel and spread out somewhat, to secure fields containing sterigmata and young spores lying singly. The slide was allowed to dry down in an incubator at 28° C. and was then re-wetted with tap water and at once stained by La Cour's modification of Newton's Crystal Violet method. The staining period was adjusted to suit the individual species, and was found to vary considerably. Some species needed only a few minutes and others as long as half an hour.

Though this simple and rapid method is not without its limitations, it is satisfactory for the particular purpose in view.

DISCUSSION

The distribution of uni- and multi-nucleate species among the fourteen groups of the *Aspergilli* is far from haphazard. Thus, uni-nucleate species only, with one or two exceptions, are found in ten groups, uni- and multi-nucleate species in the two largest groups—the *A. niger* and *A. glaucus*—and only multi-nucleate species in the *A. tamarrii* and *A. flavus-oryzae* groups.

The ultimate allocation may, of course, present a different picture from the above when the conidia of known species still outstanding—and of others which may yet be discovered—have been examined. It is possible

that an examination of a whole series of strains of some species, e.g. *A. flavus*, would show that uni-nucleate strains of species otherwise typically multi-nucleate may exist. In fact, of the two strains of *A. awamori* which were examined, one showed conidia with either one or two nuclei, while the other almost invariably only single nuclei.

The relationship between spore size and number of nuclei is perhaps the most obvious deduction to be made from the data found in the last two columns of Table 1. Species with spores which average less than 4μ are usually uni-nucleate, while those with spores having an average diameter of more than 5μ are substantially multi-nucleate. In the multi-nucleate species one finds much variation in the number of nuclei among spores from the same head, and the variability cannot always be associated with differences in spore size. This lack of constancy in the number of nuclei in spores of the same species makes it impossible to hold that there is more than a broad relationship between average spore size and the average number of nuclei. Even uni-nucleate species may not be invariably uni-nucleate—an exception is occasionally found: *A. chevalieri*, typically uni-nucleate shows two nuclei in a very small proportion of its conidia.

The nuclear figures add some support to the morphological evidence on which the groups were framed by Thom & Raper. The *A. glaucus* group provides a good example. In the *Manual*, the species having the perfect stage are arranged in two main sections: (a) species with ascospores less than 6μ , and (b) species with ascospores more than 6μ in long axis. If the size of the conidia and the number of their nuclei are used as a basis for subdivisions, the same two sections emerge quite naturally.

Average size of conidia in μ	Number of nuclei in conidia	Sub-groups or series	Section
3-6.5	1 1 1 or 2 1-4	<i>A. chevalieri</i> <i>A. amstelodami</i> <i>A. ruber</i> <i>A. repens</i>	Species with small ascospores
6-10.0	up to 12 or more	<i>A. umbrosus</i> <i>A. echinulatus</i> <i>A. medius</i> <i>A. niveo-glaucus</i>	

The nuclear data may be useful in cases where the degree of affinity between individual species is in question as, for example, in *A. awamori* and *A. luchuensis*. In the *Manual* these two species are separated; the former being regarded as close to *A. niger* mut. *schimanni*, while the latter is classed with *A. japonicus* and its allies. The fact that one strain of *A. awamori* is multi-nucleate points to closer affinity with *A. luchuensis*, also multi-nucleate, than to Schiemann's mutant which, like *A. niger*, is uni-nucleate. Blochwitz (1929, p. 232) held that *A. awamori* was synonymous with *A. luchuensis*. There are, indeed, no very great differences between the two species.

While examining the preparations, made primarily for determining the number of nuclei in conidia and sterigmata, opportunities sometimes presented themselves for making other observations, e.g. of nuclei which had just passed from the vesicle into young sterigmata and of mitotic divisions in the latter.

The passage of nuclei from the vesicle to the sterigmata, and from thence to the conidia, was followed in several species. It is safe to assume that the vesicle usually supplies only the initial complement of one or more nuclei to the sterigmata, and when the latter are in two series each of the secondary series is provided with one or more nuclei resulting from divisions in those of the primary series. Baker (1945), however, states that in *A. echinulatus*, a multi-nucleate species with only one series of sterigmata, nuclei continue to pass from the vesicle to the sterigmata as conidia are formed. No evidence has been offered that such migrations occur outside the *A. glaucus* group.

Nuclei which had just entered newly formed conidia have been recorded (Pl. 21, fig. 5). In multi-nucleate species a grouping of nuclei at the tips of the spore-bearing sterigmata is to be seen just before spore formation begins. This was noticed particularly well in *A. citrisporus* (Pl. 21, fig. 3), and in *A. tamarii*.

The derivation of the nuclei in multi-nucleate sterigmata is perhaps the most difficult matter to determine from unsectioned preparations. In the relatively large species *A. carbonarius*, however, it was possible to trace the nuclei from the vesicle to the young sterigmata with certainty. Many instances were found of nuclei which had just reached the base of a sterigma and of others which were still partly in the vesicle. In these sterigmata, a second nucleus could often be seen occupying a more central position. In such cases it was clear that the vesicle had supplied both nuclei, and that they were not the result of division within the sterigma. It was not found possible to discover whether all the nuclei in mature sterigmata were similarly directly derived from the vesicle.

Confirmation of the microscopic observations was obtained by making single spore isolations from heterokaryotic heads: *A. carbonarius* and its light brown mutant were grown together, and heterokaryotic heads in many intermediate shades of colour developed. Single spores from such heads frequently gave mixed colonies of the black *A. carbonarius* and the light brown mutant. The vesicle was thus the primary source of at least two dissimilar nuclei in the sterigmata which gave rise to the spores producing mixed colonies.

It is quite possible, however, that in other groups with multi-nucleate conidia, the vesicle may supply only one nucleus to each sterigma and that divisions then take place to make them multi-nucleate as observed. In *A. tamarii*, for example, which regularly shows several nuclei in sterigmata and conidia, it was found that heterokaryotic heads in mixed colonies of two colour mutants—a green and a white—always had chains of spores, some entirely green and some entirely white, but none of intermediate tints as might be expected if nuclei of both types sometimes passed from the vesicle to a sterigma. Until a number of single-spore isolations from such heads have been made, one cannot be certain that the absence of chains of intermediate tints is a proof that none of the spores are heterokaryotic. Pl. 21, fig. 6, shows a heterokaryotic head of the green and white mutants of *A. tamarii*.

In addition to multi-nucleate sterigmata producing multi-nucleate conidia, the latter can become multi-nucleate quite independently as a

result of divisions occurring during their formation. This was noticed in slides of *A. repens*, and Baker (1945) also observed this characteristic in the strain she studied and reports that the conidia of *A. echinulatus* (another species of the *A. glaucus* group), behave in the same way. As yet, no certain examples have been seen in species of other groups, though at times the appearance of the nuclei of young spores of *A. tamaritii* rather suggests that a division stage accounts for some of the number found.

The tendency for the number of nuclei to vary in species with multi-nucleate conidia has been mentioned earlier. Another type of variability is met with in *A. avenaceus*, a new species described by Smith (1943) belonging to the *A. wentii* group. Here it was found that most of the heads had sterigmata and conidia consistently uni-nucleate as in other species of the group. There were, however, a minority of heads in which the numbers of conidial nuclei varied from 1 to 3 (or possibly 4) in conidia from the same head. Pl. 21, fig. 4, shows a sterigma and conidium, each with two nuclei. The number of nuclei supplied by the vesicle to the sterigmata was not observed.

Finally, some further details may be given of *A. repens*, a species showing variability of the kind found in *A. avenaceus* but with the additional feature of mitotic divisions occurring in the conidia. The majority of heads have uni-nucleate sterigmata, and it was estimated that over 50% of their conidia had a single nucleus and that the remainder became bi-nucleate at the time of formation. A much smaller proportion of heads developed multi-nucleate sterigmata and conidia with from two to four nuclei each. To settle the question whether the vesicle accounted for more than one of the nuclei in multi-nucleate sterigmata, *A. repens* was grown with its white mutant. Heterokaryotic heads developed freely. They resembled those produced by mutants of *A. tamaritii* in that they were composed of green chains and white chains of spores in various proportions, but not of chains showing intermediate tints. When spores from such heads were grown singly, the resulting colonies were of either the green *A. repens*, or of its white mutant. None of the conidia tested can have had both types of nuclei. It was concluded, therefore, that in this species the vesicle as a rule provides only one nucleus to each sterigma.

SUMMARY

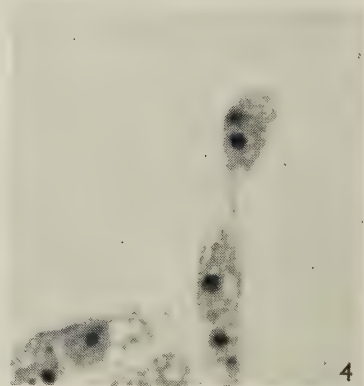
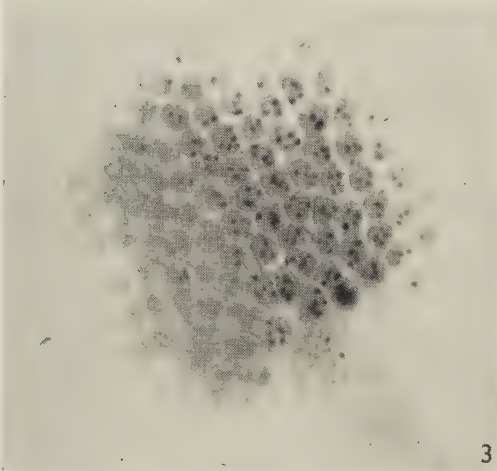
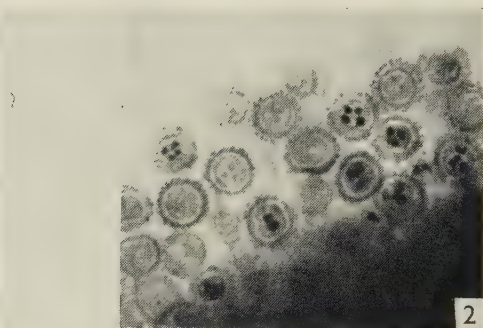
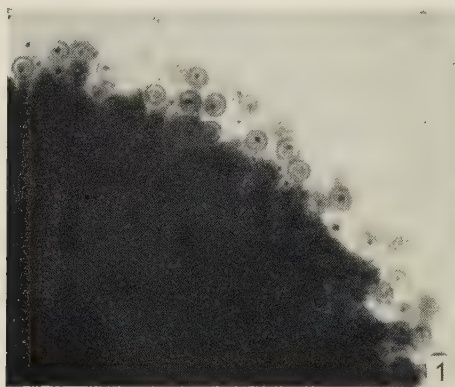
1. Examinations to determine the number of conidial nuclei characteristic of the majority of species of *Aspergillus* have been made. The results are given in Table 1.

2. Stained preparations of about sixty species were examined: approximately two-thirds have uni-nucleate and one-third multi-nucleate conidia.

3. The distribution of uni- and multi-nucleate species among the groups of the genus is not haphazard, but is generally what might be expected with genetically related species.

4. There is a close relationship between average spore size and number of nuclei: uni-nucleate spores rarely exceed 4μ in diameter, multi-nucleate spores are rarely less than 5μ .

5. The stained preparations mentioned above also gave information as



to the source of nuclei in sterigmata and conidia; single-spore isolations from heterokaryotic heads of *A. carbonarius* and mutant, confirmed the microscopic evidence that in this species, the nuclei of a single conidium are normally derived ultimately from more than one nucleus in the vesicle.

I am indebted to Mr G. Smith, Dr D. Snow and Major H. A. Dade for providing many of the cultures examined, and to my brother, J. L. Yuill, for a number of helpful criticisms in preparing this paper. Thanks are due to the Directors of John and E. Sturge (Citric) Ltd., for permission to publish this account of work done in their Laboratories.

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EXPLANATION OF PLATE 21

- Fig. 1. *Aspergillus niger*. Small portion of head with uni-nucleate conidia. $\times 960$.
- Fig. 2. *A. carbonarius*. Very small portion of head showing several multi-nucleate conidia. $\times 960$.
- Fig. 3. *A. citrisporus*. Head with multi-nucleate sterigmata. $\times 960$.
- Fig. 4. *A. avenaceus*. A sterigma and immature conidium, both bi-nucleate. $\times 2000$.
- Fig. 5. *A. ostianus*. Young conidium in which a nucleus had just entered from a secondary sterigma. $\times 2000$.
- Fig. 6. *A. tamarii*. A heterokaryotic head from a mixed culture of a green and a white mutant. $\times 250$.

(Accepted for publication 2 January 1950)

A NOTE ON THE OCCURRENCE OF *TRAMETES HISPIDA* IN ENGLAND, AND ITS CULTURAL CHARACTERISTICS

BY K. ST G. CARTWRIGHT

Forest Products Research Laboratory, Princes Risborough

(With Plates 22 and 23 and 1 Text-figure)

Trametes hispida (Bagl.) Fr. is a common species in many parts of Europe and occurs on a number of trees including *Fagus sylvatica*, being recorded both on the living tree and as a saprophyte after felling. The species is close to, if not identical with, *Trametes trogii* Berk., but is considered by Bourdot & Galzin (1927, pp. 587-589) as sufficiently distinct to list as a separate species, though they remark in a footnote that both species produce an identical rot and are biologically identical. Rea (1922, p. 614) records *T. trogii* and considers *T. hispida* as a synonym. He considered it a rare species and apparently had not seen a British specimen. Miss Wakefield told me that she could find no authentic record of it from Britain.

The specimen on which this note is based was collected in 1949 from a beech railway sleeper stored in the open at Liphook, Hants. It was stated that the sleeper had been cut from home-grown beech, but no information as to locality could be obtained.

The sporophore when collected was in active growth and measured 10 × 9 cm. (Pl. 22, fig. 1). It had a velvety brown upper surface (Pl. 22, fig. 2) with dark coloured flesh. The spore surface, which was of the daedaleoid type with thick dissepiments (Pl. 22, fig. 3), was pale greyish white but quickly turned pink to purplish red on bruising, thus agreeing closely with the variety *rhodostoma* of Quélet. It dried a dark colour. Each basidium bore, as a rule, four spores, the average size of these being 7-10 × 3-4 μ .

DESCRIPTION OF ROT

T. hispida causes a white stringy rot with numerous black flecks mostly following the medullary rays (Pl. 23, figs. 5, 6). These black flecks are due to the formation of reaction gum resulting from fungus activity. The mycelium is distributed throughout the wood elements, and simple clamp connexions are of frequent occurrence on the fine colourless hyphae. Larger hyphae with golden contents also occur. The hyphae pass from cell to cell through the pits and also by direct penetration of the cell wall. The fungus causes rapid decay of the wood under wet conditions.

ISOLATION AND DESCRIPTION OF THE FUNGUS IN CULTURE

A pure culture of the fungus was readily obtained from sporophore tissue, and grew satisfactorily on 5 % malt agar medium.

Cultures were grown both in the light at laboratory temperature, and also in an incubator at 22° C. Growth is more rapid in an incubator in the dark than at laboratory temperature in daylight, and the development of aerial mycelium more pronounced, but the general appearance of the cultures is similar.

In some cultures from first isolations a Pinkish Buff (Ridgway) to Ochre daedaleoid pore surface is formed at the upper end of the culture tube within a period of 2 weeks (Pl. 23). Fresh isolations from actively growing sporophore tissue of the higher Basidiomycetes often fruit rapidly, whereas later transplants may lose this ability. Growth of the fungus on 5 % malt agar medium is at first nearly colourless, soon becoming white, when it has a powdery appearance, with a white hyaline growing zone. Later there is a great development of woolly aerial mycelium. Non-fruiting cultures become coloured a uniform greyish to Pinkish Buff. In the dark the aerial hyphal development is more profuse and is Light Ochraceous with a white growing edge to the culture.

In mature cultures the colour becomes darker, ranging from Isabelle, Buffy Brown to Chestnut, the mat consisting of hyphae of a fibrous to hairy texture.

The hyphae at the growing edge are white to colourless and average 1–3 μ in diameter. Branching is usually at an angle of about 30° and the hyphae bear frequent simple clamp connexions. Interspersed with them are larger hyphae, with yellowish brown contents averaging 9–10 μ in diameter, some of which have groups of crystalline spicules on their surface. In addition, there are large hyphae of fairly uniform diameter with coloured contents in which the branching is pseudo-dichotomous in appearance. These hyphae bear no clamp connexions nor spicules, and resemble those 'lactiferous' hyphae described in cultures of *Fistulina hepatica*.

The aerial mat tends to become tufted, the tufts consisting of groups of hyphae running parallel to each other. The ends of these hyphae are swollen into spherical vesicles. This represents the initiation of pore formation and later a normal hymenial surface is formed which, provided the atmosphere within the culture tube is sufficiently humid, produces abundant basidiospores. The mat reddens on bruising in the same manner as does the sporophore.

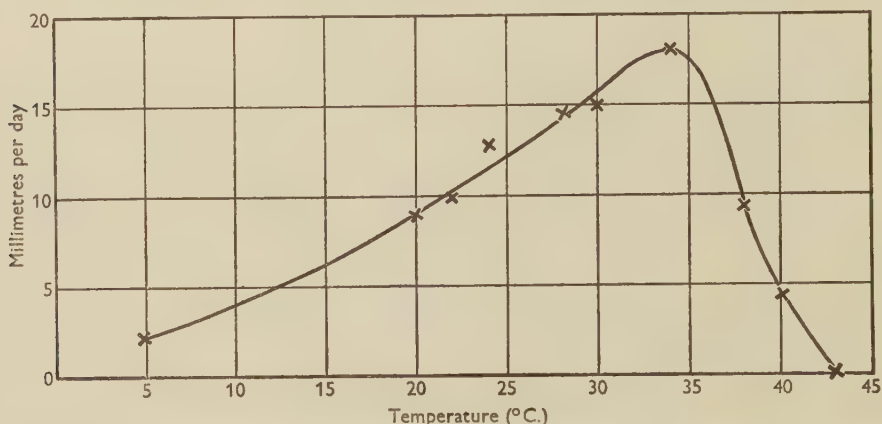
The submerged mycelium consists of a fine network of colourless hyphae with simple clamps. Spherical swellings are sometimes present. Interspersed in the network large hyphae with coloured contents and bearing crystalline spicules also occur.

TEMPERATURE AND RATE OF GROWTH

Trametes hispida grows over a wider range of temperature than most of our common British species, growth taking place from 5 to 42° C. and ceasing at 43° C.

The maximum daily rate of growth based on the average diameter increment readings in mm. of six Petri dishes occurs at 34° C., above which there is a fairly rapid decline, growth ceasing at 43° C. (Text-fig. 1).

This optimum ($34^{\circ}\text{C}.$) is far higher than is usual for most of our species, which is about $27^{\circ}\text{C}.$, and in most species growth ceases at between 30 and $35^{\circ}\text{C}.$



Text-fig. 1. *Trametes hispida*. Temperature and rate of growth curve based on average daily diameter increase in millimetres of 6 petri dish cultures grown on 5% malt agar medium.

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EXPLANATION OF PLATES 22 AND 23

PLATE 22

- Fig. 1. *Trametes hispida* sporophore. Approximately natural size.
 Fig. 2. Portion of upper surface of sporophore. $\times 4$.
 Fig. 3. Pore surface of sporophore. $\times 4$.

PLATE 23

- Fig. 4. Fruiting culture on 5% malt agar medium slightly reduced.
 Fig. 5. Beech wood block after 5 weeks' exposure to attack, transverse surface. $\times 6$.
 Fig. 6. Beech wood block after 5 weeks' exposure to attack, tangential surface. $\times 6$.

(Accepted for publication 11 January 1950)

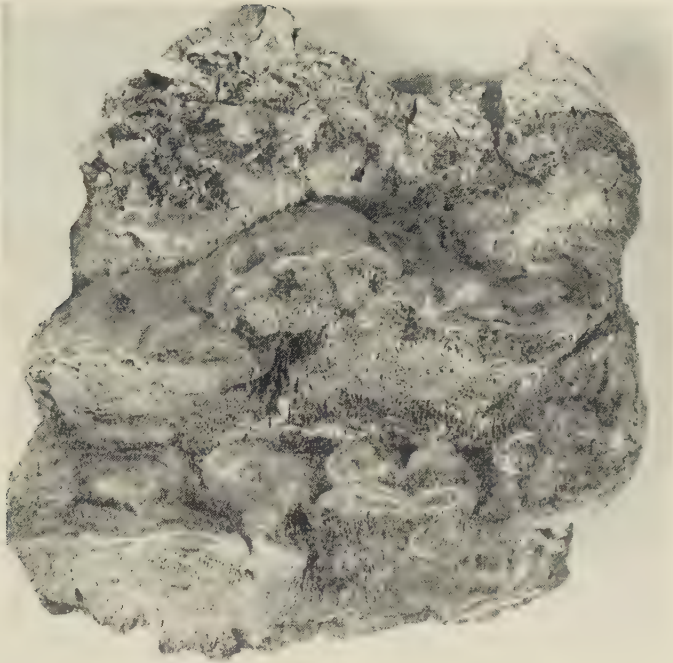


Fig. 1



Fig. 2

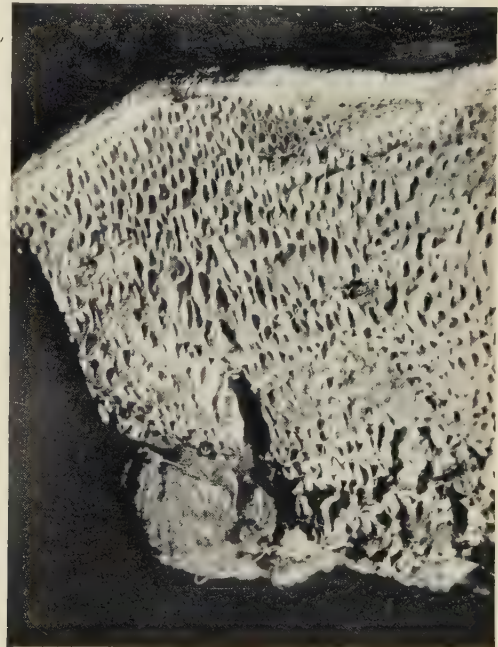


Fig. 3



Fig. 4

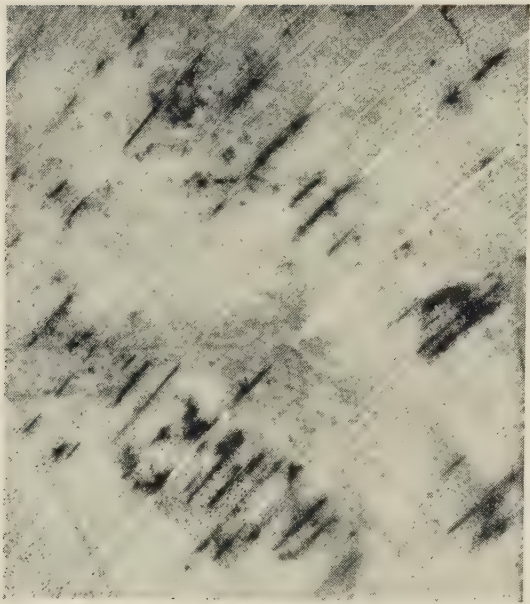


Fig. 5



Fig. 6

STUDIES ON BRITISH CHYTRIDS

IX. *ANISOLPIDIUM STIGEOCLONII* (DE WILDEMAN) N.COMB.

By HILDA M. CANTER*

*Freshwater Biological Association, Wray Castle, Ambleside; and
Botany Department, Birkbeck College, University of London*

(With Plates 24-26 and 6 Text-figures)

De Wildeman (1900, 1931) described *Olpidium stigeoclonii* a parasite, producing marked hypertrophy of the cells of *Stigeoclonium* sp. The complete life cycle was not followed and, owing to the confusing description of zoospore discharge, the exact systematic position of this fungus has remained in doubt. Prof. J. Karling (*in lit.*) reports finding the fungus in America, and Prof. C. T. Ingold (personal communication) found it parasitizing *Stigeoclonium* sp. in a stream draining Cropston Reservoir in Leicestershire, England, 21 December 1942, but neither saw the zoospores. In January and February 1949 I discovered abundant material in *S. subuligerum* Kütz. and *Stigeoclonium* sp.† epiphytic on reed stems in Sandy Wyke Bay, Windermere. From the same locality a few sporangia were found in the apical cells of *Draparnaldia plumosa* (Vauch.) Ag. Infected *Stigeoclonium* plants were also collected from Coniston Water in July and Ullswater in July and September 1949.

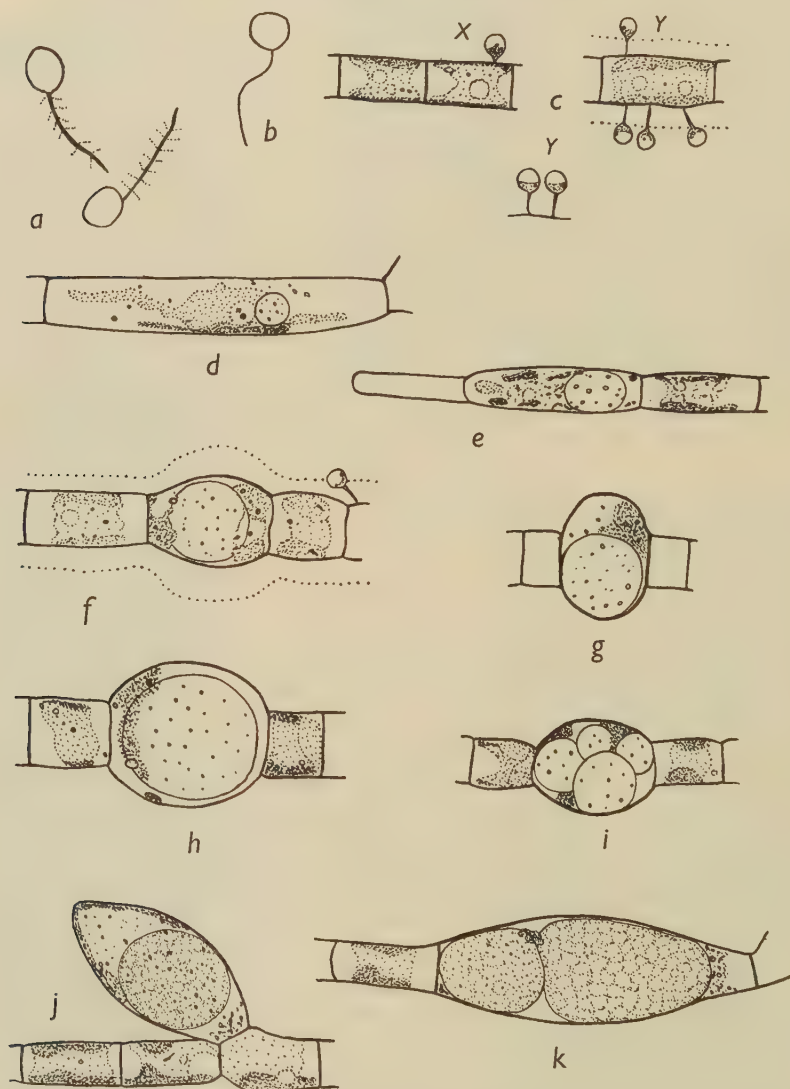
LIFE HISTORY

Infection of the host is brought about by zoospores. The presence or absence of a mucilage sheath around the host filament is a variable feature. If no sheath is present the zoospore comes to rest, encysts and germinates on the cellulose wall (Text-fig. 1c (x)), but if a mucilage sheath is present, it germinates on this so that there is a distinct germ tube outside the host cell (Text-fig. 1c (y)). In *Draparnaldia* where the sheath is very thick the germ tube is exceptionally long. The infecting zoospore has granular contents including a bright lateral granule, and gradually these contents pass into the host cell. The first clearly visible sign of the fungus within its host is a small spherical body containing a few refractive globules in a hyaline matrix and surrounded by a thin cell wall (Text-fig. 1d and Pl. 24, fig. 3). At this stage the parasite is often located near the host nucleus and is apparently no longer connected with the infecting germ tube. As the parasite grows its contents become more foamy, and finally the whole thallus is converted into a spherical (13-33 μ diameter) or oval (9 $\times$ 21-21 $\times$ 46 μ) sporangium. Any cell of the host, from base to apex, may be attacked. The sporangium may fit quite loosely, but on the other hand it may completely fill the host-cell which, as a result of infection, swells considerably. Between the wall of the parasite and that of the host the

* Mrs J. W. G. Lund.

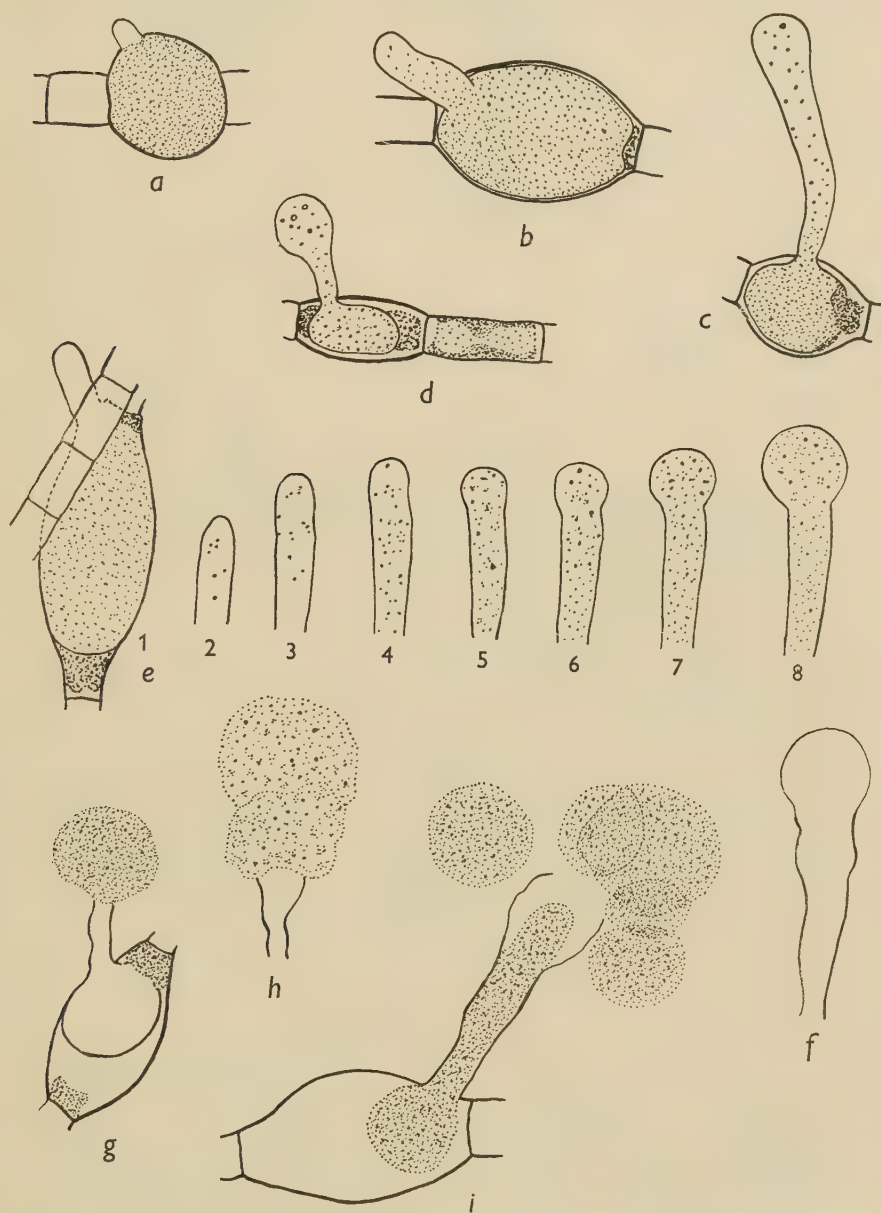
† The fungus was again collected during the same months in 1950.

shrunk chloroplast can usually be seen, and as noted by De Wildeman (1931), it retains its green colour. Usually there is only one sporangium in a cell, but as many as four have been seen (Text-fig. 1*i*). When the sporangium is mature a hyaline papilla, or very rarely two, penetrate the host wall (Text-fig. 2*a*, *b*). At this stage the contents of the sporangium are evenly and densely granular. The papilla elongates and becomes an

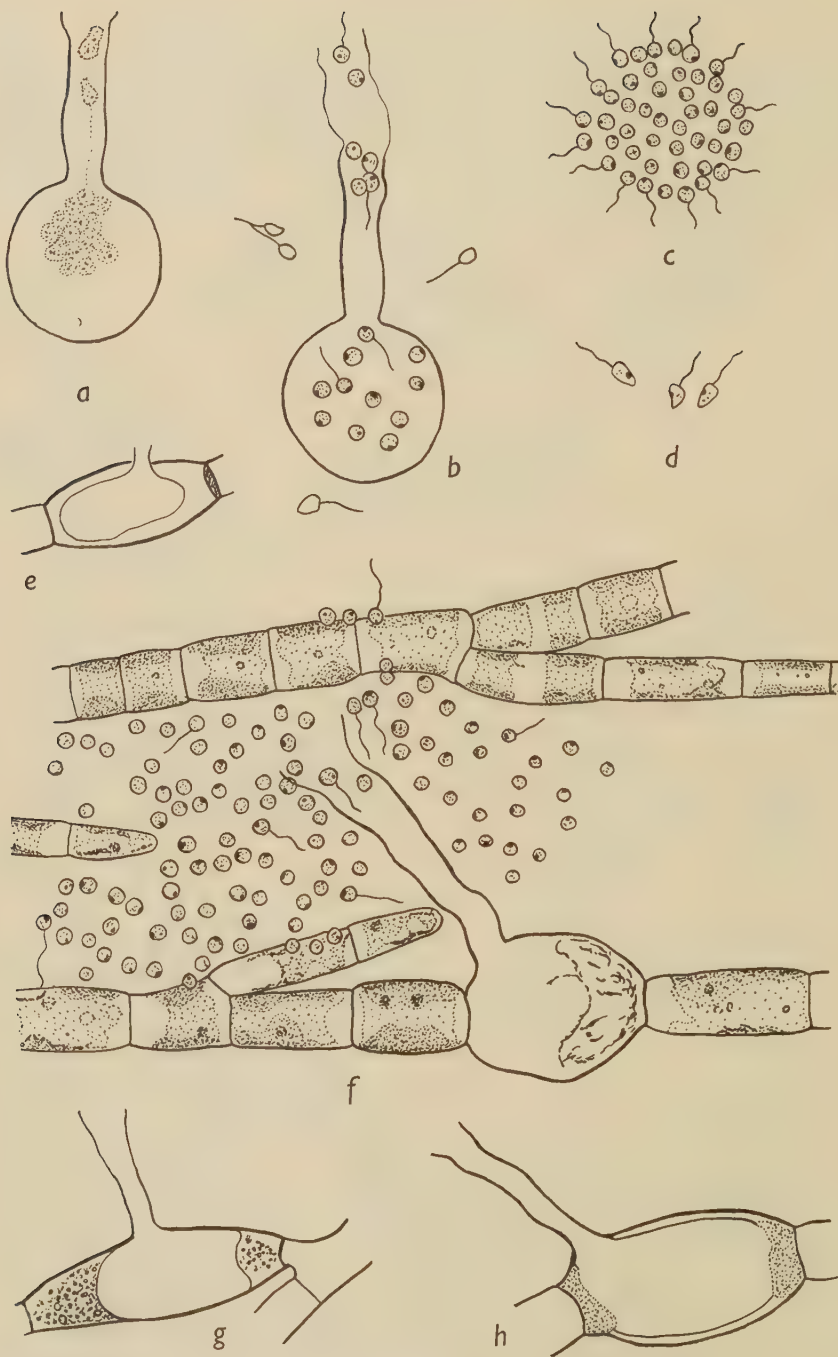


Text-fig. 1. *Anisolpidium stigeoclonii* (de Wildeman) n.comb. *a*, zoospores stained to show 'insel' flagella. *b*, zoospore in which the flagellum shows no 'insels'. *c*, zoospores recently settled on a host cell (*x*) or on the mucilage surrounding it (*y*). *d*, very young fungal thallus situated beside the host cell nucleus. *e-i*, young thalli with hyaline content and a few refractive globules. *j*, *k*, later stages in thallus development when the protoplasm has become more foamy, *a*, *b*, $\times 1400$ the rest, $\times 800$.

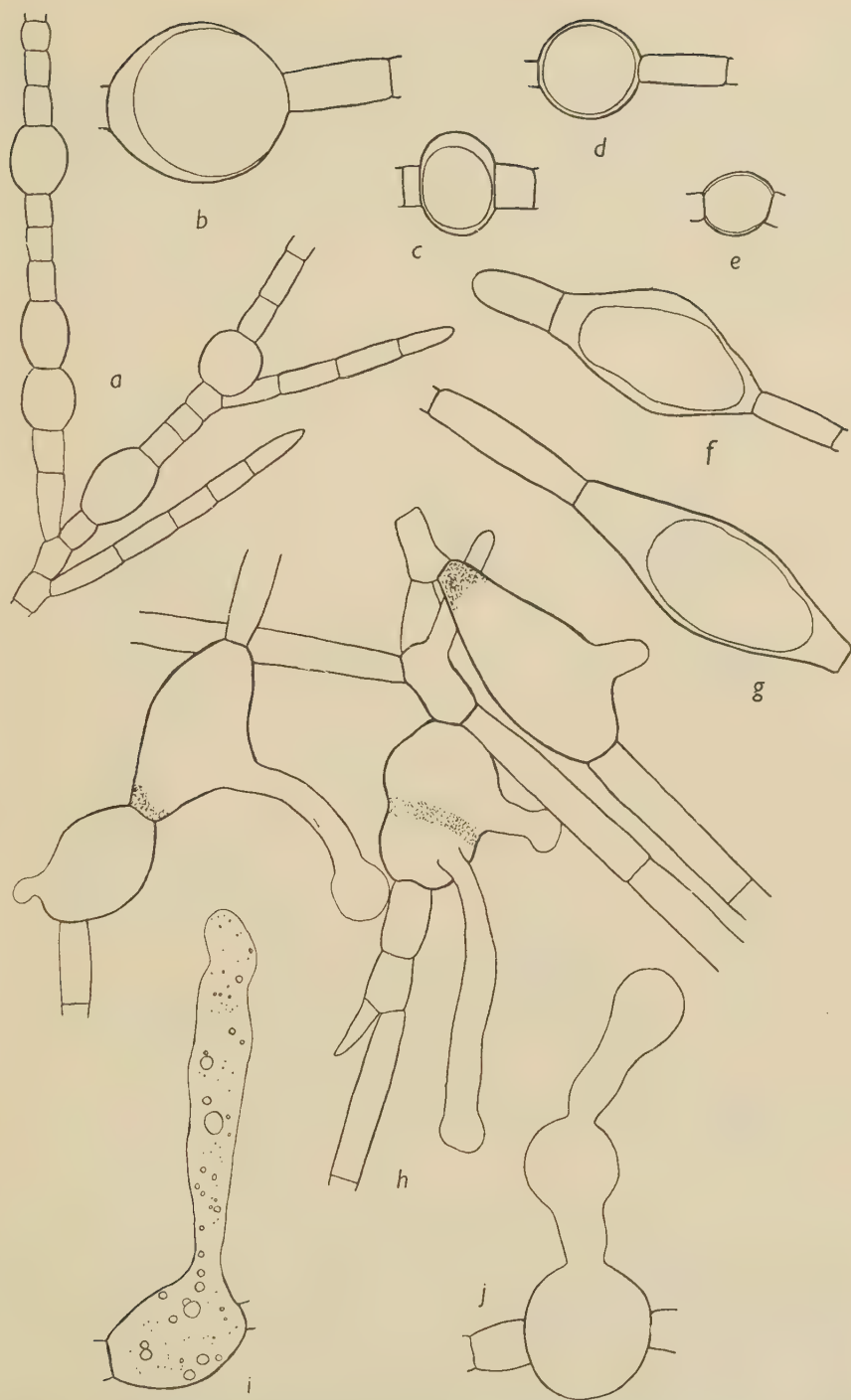
exit tube, as it lengthens it comes to contain widely separate granules. The apex of the exit tube has a thin wall (Text-fig. 2*f*) which at length swells slightly. It may remain like this for some time but finally the apical



Text-fig. 2. *Anisolpidium stigeoclonii* (de Wildeman) n.comb. *a-d*, stages in the formation of the exit tube. *e*, stages in development of a single exit tube (1) 5.40 p.m., (2) 5.55 p.m., (3) 6.20 p.m., (4) 6.37 p.m., (5) 6.50 p.m., (6) 7.0 p.m., (7) 7.10 p.m., (8) 8.7 p.m. *f*, a specimen which had reached the stage shown in *e*. (8) after squashing. The thin wall surrounding the apical bulge is seen. *g-i*, emergence of the thallus protoplasm. All $\times 800$.

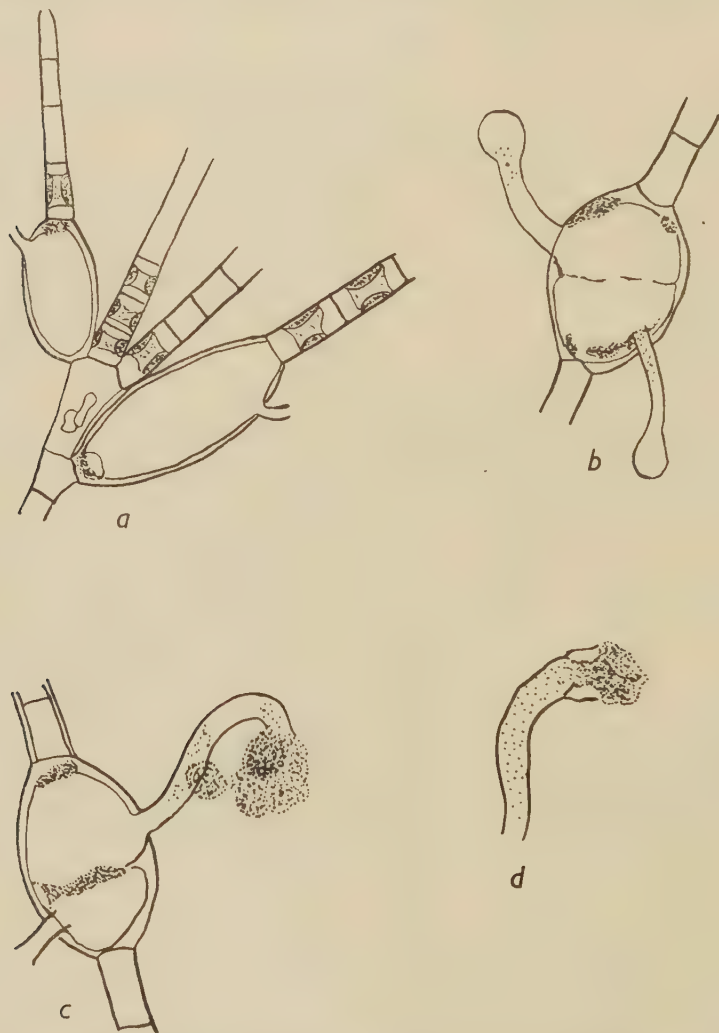


Text-fig. 3. *Anisolpidium stigeoclonii* (de Wildeman) n.comb. *a*, protoplasm which has remained in the exit tube and sporangium undergoing cleavage into zoospores. The dotted line represents a fine hyaloplasmic connexion (see also Karling, 1944, fig. 31). *b*, sporangium containing fully formed zoospores; thin-walled apical portion of exit tube especially clear. *c*, zoospore mass with halo of flagella. *d*, motile zoospores. *e-h*, dehiscent sporangia; in *f* many quiescent zoospores remain close to the exit tube. All $\times 800$.



Text-fig. 4. *Anisopidium stigeoclonii* (De Wildeman) n.comb. *a*, part of a filament showing five infected host cells. *b-g*, thalli showing range of size and shape. *h*, several thalli forming exit tubes at the same time. *i, j*, abnormal developments of the exit tube. The content is omitted in all except *i* for simplicity. *a*, $\times 415$; the rest, $\times 600$.

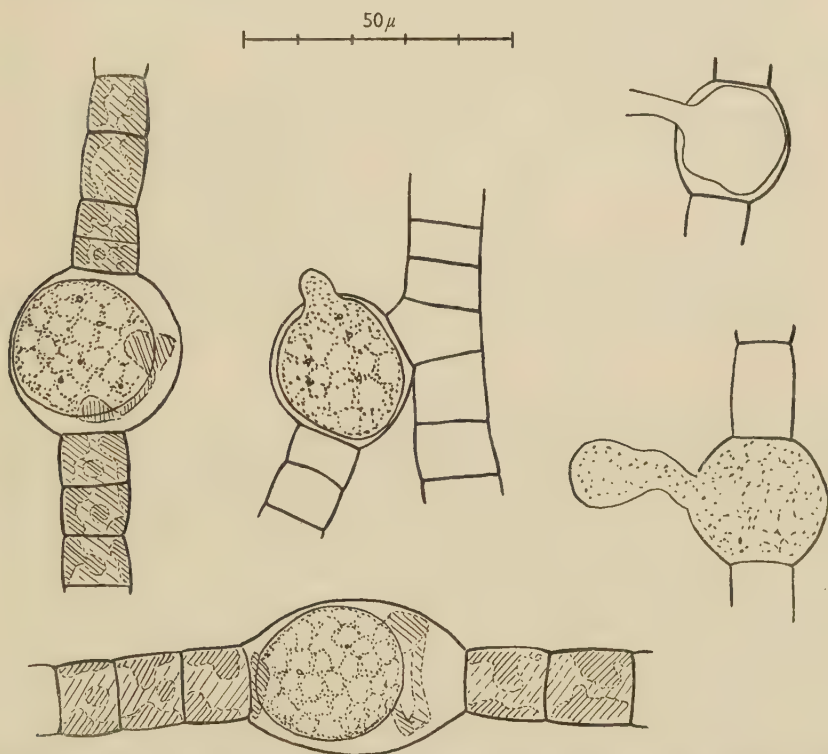
swelling expands, bursts and the contents stream out into the surrounding water forming a single naked mass (Text-fig. 2*g* and Pl. 26, fig. 1), or a small number of separated masses (Text-fig. 2*i*). The end of the burst exit tube is funnel-shaped (Pl. 26, fig. 4), a feature also noted by De Wildeman (Text-fig. 5*d*). Once liberated the naked protoplasmic masses become



Text-fig. 5. *Olpidium stigeoclonii* after De Wildeman (1931). *a*, empty sporangia *b*, two thalli with exit tubes. *c*, *d*, emergence of the naked protoplasm to form undifferentiated zoospore masses at the tip of the exit tube.

irregular and more diffuse. Then delimitation of zoospores occurs and soon short flagella, which gradually increase in length, appear, forming a waving fringe on the outer surface of each mass (Text-fig. 3*c*). The time from the rupture of the sporangium to the formation of zoospores is about 30 min.

Sometimes small portions of protoplasm remain in the exit tube and sporangium where they differentiate into zoospores (Text-fig. 3*a*), a type of behaviour noted by Karling (1944) as occurring in *Rhizidiomyces apophysatus* Zopf. Another abnormality seen by Karling was the extension of the exit tube to a great length without zoospore formation. This I have also seen but to a lesser degree in the *Stigeoclonium* parasite (Text-fig. 4*i,j*). The zoospore varies in shape but when actively swimming it is obpiriform, and the broad anterior end bears the relatively short flagellum. The content of the zoospore is granular with a bright lateral granule. Its



Text-fig. 6. *Anisolpidium stigeoclonii* (De Wildeman) n.comb. parasite in *Stigeoclonium* sp. (itself epiphytic on *Cladophora* sp. from a stream draining Cropston Reservoir. The drawings were made by Prof. C. T. Ingold.

movement is smooth, gliding with frequent changes of direction with often a tendency to go round in circles. The flagella were stained by Couch's (1941) modification of Löffler's technique. Although some flagella possessed tinsels (Text-fig. 1*a*), the evidence is not conclusive as on many no tinsels could be seen. This may possibly be due to the lack of previous experience in the use of this method.

After zoospore discharge the sporangium tends to collapse and for this reason all measurements must be based on mature undehisced specimens. When the sporangium is empty it is clear that even when the parasite

completely fills the host cell the wall of the host and parasite never fuse. No resting spores were found nor have they been seen by other workers.

Table 1. *The two series of forms within the Anisochytridiales*

(A) Zoospores fully formed within the sporangium	(B) Zoospores mature outside the sporangium
1. ANISOLPIDIACEAE	
<i>Anisolpidium rosenvingii</i> (Petersen) Karling	
<i>A. sphacellarum</i> (Kny) Karling	<i>Anisolpidium stigeoclonii</i> De Wildeman n. comb.
<i>Reesia amoeboides</i> Fisch	
<i>R. Lemnae</i> (Fisch) Karling	
<i>Cystochytrium radicale</i> Cook	
2. RHIZIDIOMYCETACEAE	
<i>Latrostium comprimens</i> Zopf.	<i>Rhizidiomyces apophysatus</i> Zopf.
	<i>R. Hansonii</i> * Karling
	<i>R. hirsutus</i> Karling
	<i>R. Ichneumon</i> Gobi
	<i>R. bivellatus</i> Nabel
3. HYPHOCHYTRIACEAE	
<i>Hyphochytrium hydrodictyii</i> Valkanov	<i>Hyphochytrium catenoides</i> Karling
<i>H. infestans</i> Zopf	

* In Karling (1945) the specific name of this species is occasionally given as *Hansonae*.

DISCUSSION

From an examination of De Wildeman's figures of *Olpidium stigeoclonii* there can be little doubt that the fungus described above is the same species. It is now clear that it finds its true place in the Anisochytridiales (Karling) in which the Olpidioid members are distributed amongst the genera *Anisolpidium* Karling, *Cystochytrium* Cook and *Reesia* Fisch. The representatives of these genera are parasites on marine algae, roots of *Veronica Beccabunga* and plants of *Lemna* spp. respectively.

It was noted by Karling (1943, p. 643) that the genera of monocentric, eucarpic anisochytrids (included in the Rhizidiomycetaceae) differ markedly in sporogenesis. In *Rhizidiomyces* the cleavage into zoospores occurs outside the sporangium, but in *Latrostium* the zoospores are fully formed within the sporangium. For this reason Karling is not certain that they should be placed in the same family. A similar condition is found among the polycentric anisochytrids, but here species with different types of sporogenesis are placed within the same genus. *Hyphochytrium hydrodictyii* Valkanov and *H. infestans* Zopf resemble *Latrostium*, while *Hyphochytrium catenoides* Karling resembles *Rhizidiomyces* spp. With the discovery of the true nature of *Olpidium stigeoclonii* these two types of sporogenesis now occur among the Olpidioid forms of anisochytrids. In its mode of spore delimitation and in the character of its dehiscence tube the *Stigeoclonium* parasite clearly resembles species of *Rhizidiomyces*. It is now even more apparent that there are two definite series among the anisochytrids, see Table 1. However, more species must be found before the significance of this difference in sporogenesis can be evaluated. In discussing this problem Sparrow (1943, p. 477) says 'It should be noted, however, that

though *Latrostium* and *Rhizidiomyces* are alike in the character of their zoospores, they differ markedly in the manner of forming them, which indicates only a distant relationship'.

The question remains: should a new genus be erected for the fungus under consideration, or should it be included in *Anisolpidium*? In our present state of knowledge I am inclined to the latter course. The name becomes *Anisolpidium stigeoclonii* and the following revised diagnosis is proposed.

***Anisolpidium stigeoclonii* (de Wildeman) n.comb.**

Thalli 1-4 partly or completely filling hypertrophied host cell; hyaline smooth spherical $13-23\ \mu$ in diameter or oval, $9 \times 21-21 \times 46\ \mu$ with one exit tube (very rarely two) elongate, $3-70\ \mu$ long; $3-8\ \mu$ broad, wall thinner at apex. Content of thallus emerging as one or several undifferentiated naked protoplasmic masses which undergo cleavage into zoospores. Motile zoospores obpyriform $5\ \mu$ long $\times 2.5\ \mu$ wide at the apex, broad anterior end with single anterior flagellum $7.5\ \mu$ long; content granular with a bright lateral granule.

Parasitic in *Stigeoclonium subuligerum*, *Stigeoclonium* sp. and *Draparnaldia plumosa* from Windermere; *Stigeoclonium* spp. from Coniston Water and Ullswater, the English Lake District and on *Stigeoclonium* sp. from a stream draining Cropston Reservoir, Leicestershire, England.

My thanks are due to Miss B. Knudson who gave me several collections of reeds from Sandy Wyke Bay, Windermere, and especially to Prof. C. T. Ingold for permission to publish his drawing and for his kind help in the preparation of the manuscript.

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EXPLANATION OF PLATES 24-26

Anisolpidium stigeoclonii De Wildeman n.comb. All photographs were taken from living material except Pl. 26, fig. 3, which was fixed in iodine. Magnifications: Pl. 24, fig. 1, $\times 290$; the rest $\times 1200$.

PLATE 24

- Fig. 1. Low-power view of *Stigeoclonium* filaments. Swollen cells are infected with *Anisolpidium stigeoclonii*.
Fig. 2. A zoospore which has settled on the mucilage surrounding a host cell; a fine thread passes to the algal wall.
Fig. 3. Empty zoospore case; spherical fungus body inside host cell.
Fig. 4. Young thallus. The host cell is slightly hypertrophied and the chloroplast squashed towards its lower end.
Fig. 5. Two thalli in one algal cell.
Fig. 6. Spherical, almost mature thallus.

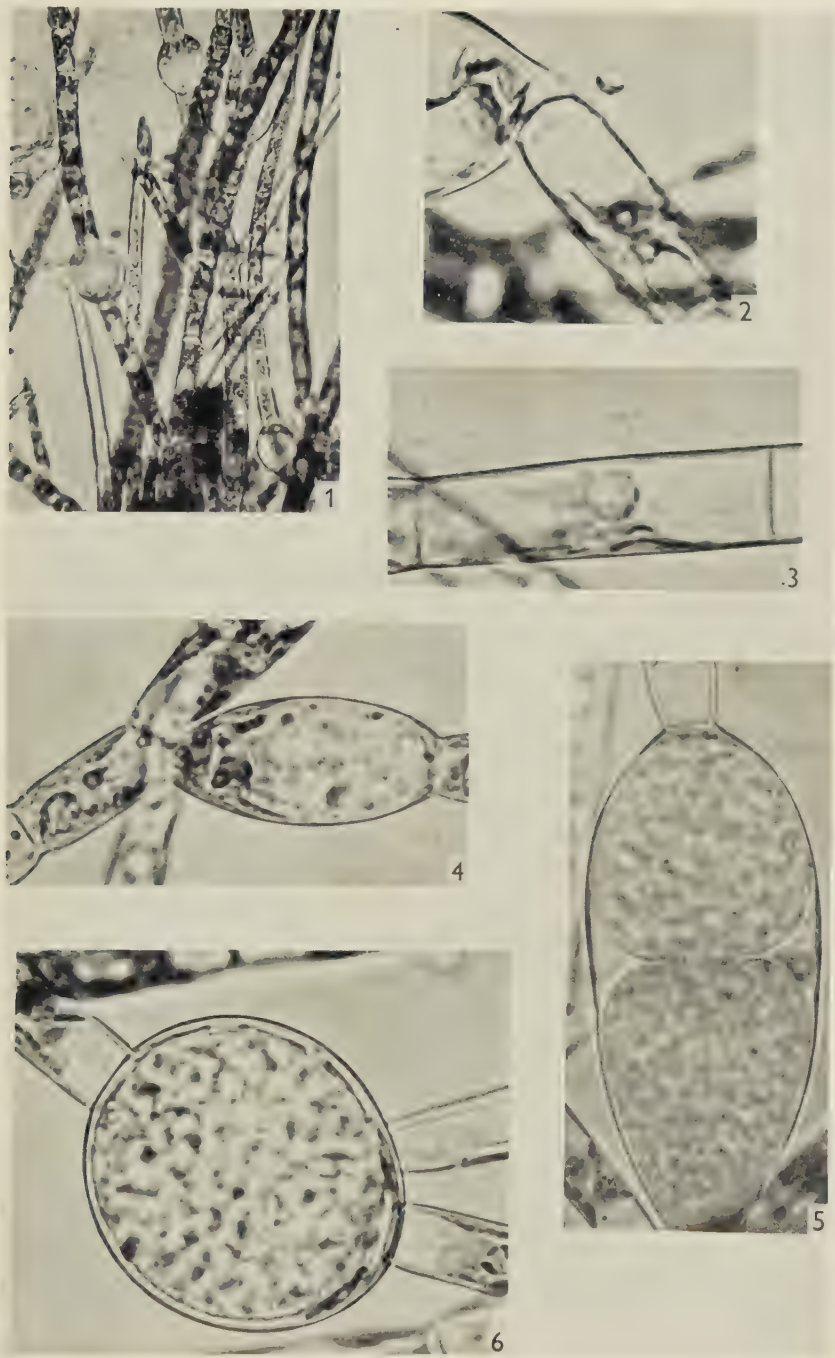
PLATE 25

- Fig. 1. Oval thallus in much swollen algal cell.
Fig. 2. Earliest stage in the development of the exit tube.
Fig. 3. Thallus with narrow elongate exit tube.
Fig. 4. The specimen shown in fig. 3 some time later. The apical swelling of the exit tube has begun to form.
Fig. 5. Large sporangium with long broad exit tube.

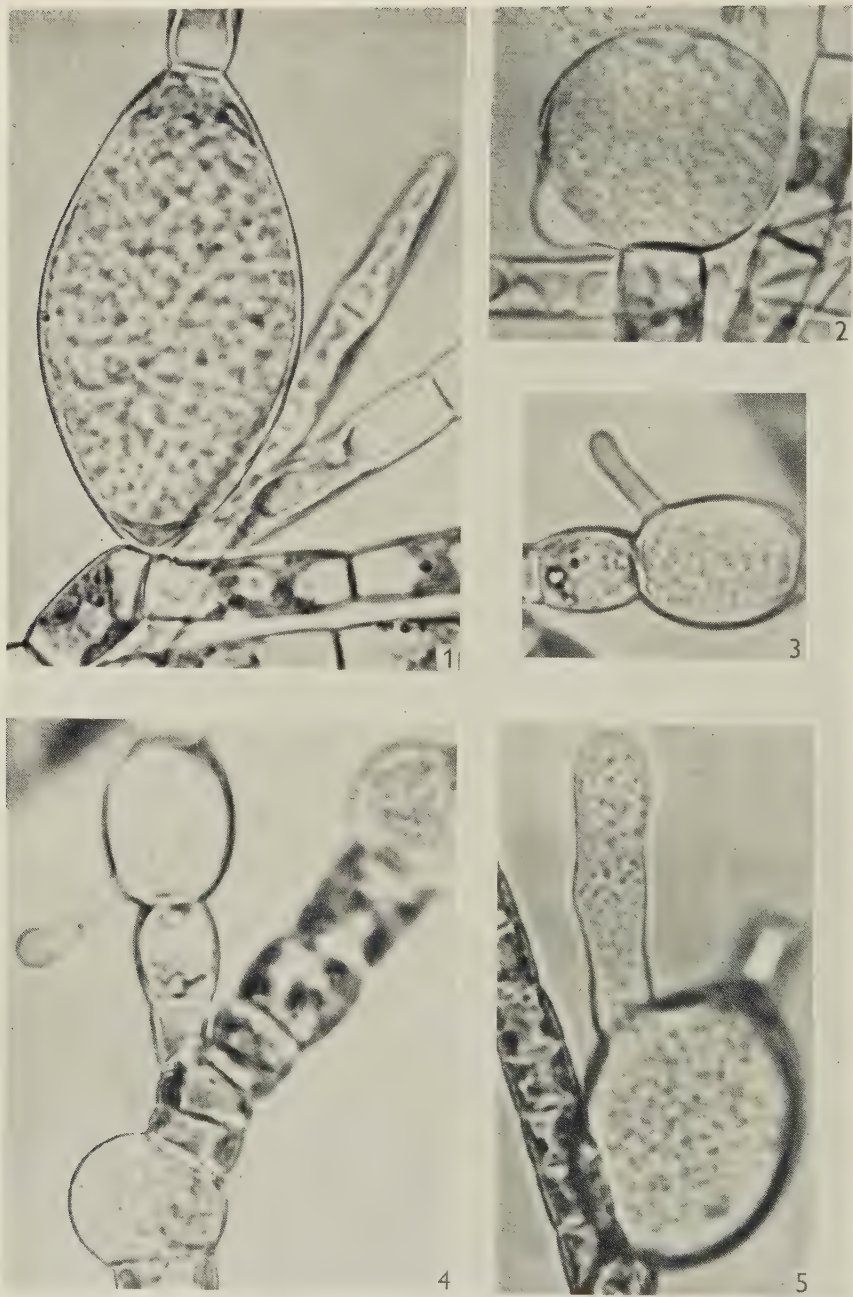
PLATE 26

- Fig. 1. Most of the content of the sporangium has already passed out to form a spherical mass at the tip of the exit tube. At the time of the photograph protoplasm was still passing through the exit tube. The funnel-shaped thin-walled apex is clearly visible.
Fig. 2. Differentiating zoospore mass.
Fig. 3. Zoospores with a single flagellum. The specimens are fixed in iodine and do not give a true picture of the living zoospore.
Fig. 4. Empty thallus with exit tube, thin-walled apical portion of latter well shown. Healthy host cell on the right bears a recently encysted zoospore.

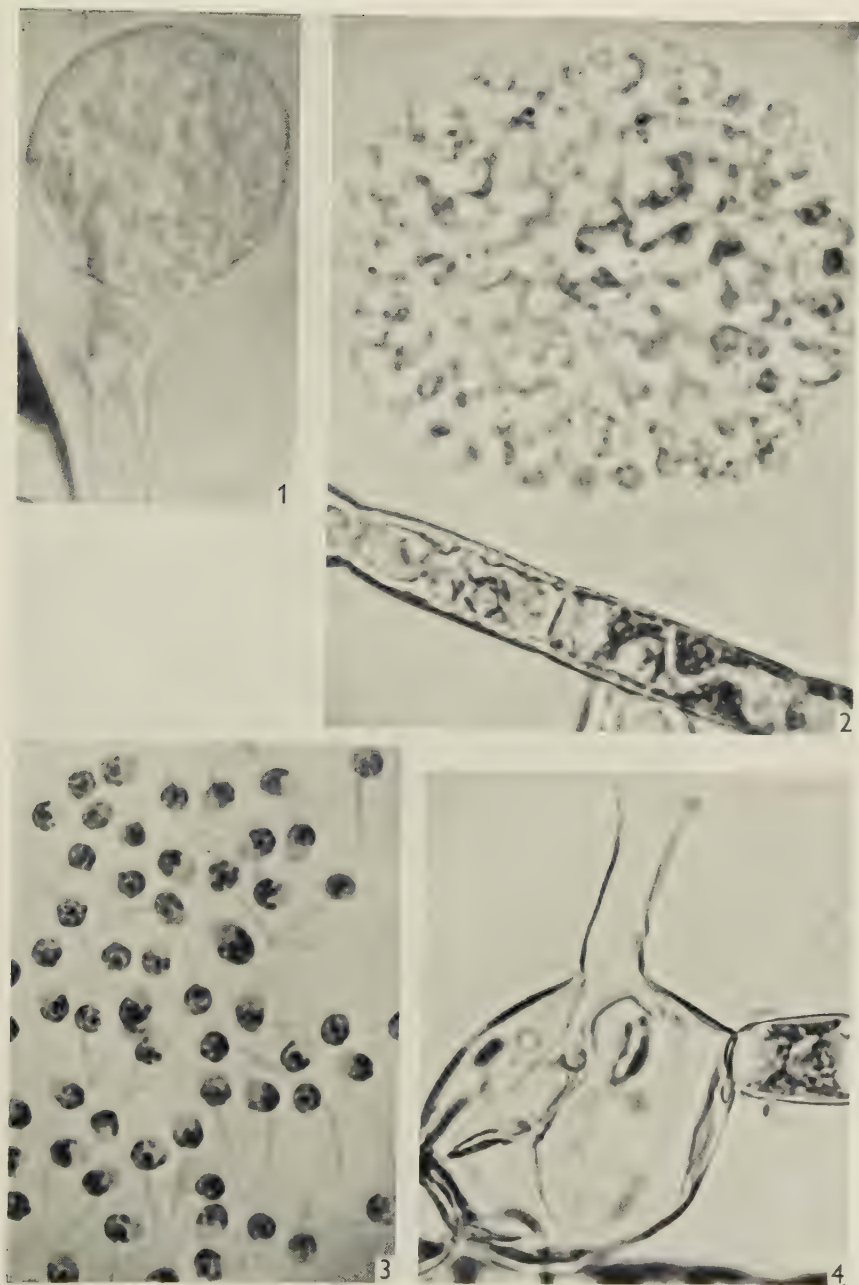
(Accepted for publication 16 January 1950)



Figs. 1-6



Figs. 1-5



Figs. 1-4

ON THE *ASCOCHYTA* SPOT DISEASE OF BROAD BEANS

BY A. BEAUMONT

*National Agricultural Advisory Service, Quarry Dene, Leeds 6**

(With Plate 27)

Ascochyta spot diseases of broad beans, recorded at different times in many places, have been ascribed to *A. pisi* Lib., *A. fabae* Speg. and *A. pisi* Lib. var. *fabae* Speg. Judging from the descriptions there can be no doubt that all refer to the same disease, which was first recorded in 1899 in England (Carruthers, 1899) and the Argentine (Spegazzini, 1899).

It was not recorded in England again until it was found in Devon in May 1927 (Pethybridge, 1929), and since then it has recurred most seasons in that county. It has also been reported from many other English counties (Pethybridge, Moore & Smith, 1934; Moore, 1943, 1948), on bean seed in Scotland (Dennis & Foister, 1942) and on bean crops in many other parts of the world.

SYMPTOMS

The fungus causes spots on the leaves, stems and pods. On the leaves the spots are more or less circular up to 1 cm. diameter, slightly sunken with a definite margin and dark chocolate brown in colour with sometimes a paler centre. Most spots bear prominent pycnidia which are concentrically arranged and exude spores in tendrils in damp weather. At a later stage many of the spots coalesce, forming irregular patches and turning almost black. The disease is then easily confused with Chocolate Spot from which it can, however, be readily distinguished by the presence of the pycnidia (Pl. 27, fig. 1).

Spots are usually less abundant on the stem, but similar to those on the leaf, though generally smaller and more deeply sunken. In wet weather in the summer, spots may appear on the pods and are exactly like those on the leaves except that they are more sunken. The spots become black, coalesce, and bear abundant spores. The mycelium often grows through the pod on to the seed, on which it forms usually circular but often indefinite dark brown spots. When the seeds are kept in moist sand the spots enlarge, the advancing margin being dark brown and the rest light brown, and pycnidia appear in abundance.

The disease is first seen in March and April. In most seasons when rainfall is low, only a few leaves are affected, and the disease can be found only after a careful search. In exceptionally wet seasons leaf spots may become common on almost every plant and, as was observed in a small field of Johnston's Wonderful in Devon in 1928, the stalks may also be attacked, with partial collapse of the plant and a consequent serious reduction in

* Formerly of Seale-Hayne Agricultural College, Newton Abbot, Devon.

crop. Such losses are, however, rare, so that the economic importance of the disease is slight.

LIFE HISTORY

Like *A. pisi* on pea, the fungus perpetuates itself on the bean seed. This is confirmed by observations on plants grown in different places from the same batch of seed, and on plants grown from seed saved from affected crops. In an experiment with seed saved in 1930 the seed was sown in plots in different situations and on different dates, namely 5, 9 and 15 December 1930 and 25 February 1931. The disease first appeared on 25 May on the first-sown plot. There was no appreciable damage to the crop, but showery weather in July led to considerable pod infection (Pl. 27, fig. 2). The February-sown plots showed the least amount of disease on both leaves and pods. The date of planting experiment was repeated with seed saved from these plots, the sowing dates being 17 November and 1 December 1931, and 7 March and 28 May 1932. There was a small amount of disease on the November and December-sown plots in May 1932, and a number of pods were affected in July on all except the last-sown plot. The amount of disease in all plots was much less than in 1931. Seed was saved each year subsequently until 1936 but no disease was seen after 1933.

No evidence has been found of infection taking place from the soil. Pycnidia have been found on decayed bean stalks late in the season, and Yu (1947), in China, found the spores could remain viable on the stalks through the winter. In my experience the spores of *A. pisi* do not remain viable in pycnidia on decayed pea stalks in this country.

MORPHOLOGY

On the host plant the Devon specimens showed pycnidia mostly 120–150 μ (range 80–200 μ), ostiole 30–50 μ , pycnosporos mostly 15–18 $\times$ 4–5 μ (range 12–23 $\times$ 4–6 μ) with rounded ends, 1-septate, very rarely continuous, not constricted, hyaline. There was a great deal of variation in the different specimens, as also found by other observers. Spegazzini (1899) gives pycnidia 100–120 μ , ostiole 15 μ , and spores 10–25 $\times$ 5–6 μ , while Sprague (1929) gives pycnidia 80–250 μ and spores 14–25 $\times$ 3.5–6 μ .

In artificial culture the spores show a similar range in size, 14–23 $\times$ 3–6 μ , mostly 18–20 μ , and commonly show a proportion of 2- or 3-septate spores, which I have not found on the natural host.

If the bean fungus is compared with *A. pisi* on pea, it is seen that the pea fungus has appreciably smaller spores, viz. 10–14 $\times$ 3–5 μ , mostly 11–12 μ long. There is the same range of spore dimensions in artificial culture, in which only 1-septate spores are found. In agar cultures a large number of pycnidia are formed by *A. pisi* from pea but only a small number by the bean fungus. Correspondingly, mycelium is scanty in cultures of the pea fungus and profuse in the bean form. This is also noted by Sprague (1929).

On sterilized bean stalks and seeds the bean form grows luxuriantly and forms abundant pycnidia which spore profusely. The pea fungus also forms numerous pycnidia, but growth and spore formation are much less

vigorous. On sterilized pea stalks the reverse is the case and the bean form produces relatively few pycnidia.

Thus the pea and bean fungi show certain well-marked differences, as admitted by all observers. Some, like Spegazzini (1899), regard these differences as of specific rank; others, like Sprague (1929) and Sattar (1934), think they are much less important and include both fungi under *A. pisi*. It seems to me that it is most logical to give specific rank to differences of the present order unless it can be shown that these differences are not constant but are related to environment. For example, if the spore size of *A. pisi* on pea is different when the fungus is inoculated to bean, this character would clearly depend on the host and would not be considered of specific rank.

CROSS-INOCULATION EXPERIMENTS

A preliminary series of cross-inoculations from single spore cultures was carried out on detached leaves in dishes. Lesions were obtained with the pea fungus on pea in two out of three experiments and on bean in five out of five; with the bean fungus on pea in two out of five and on bean in four out of five. Spores were formed only twice, once with the pea fungus on pea and once with the pea fungus on bean, and each time the spore size was characteristic of the pea fungus. As detached leaves soon become moribund these experiments do not provide an exact comparison of the pathogenicity of the pea and bean fungi. This was obtained by inoculations carried out on plants in pots, using spore suspensions from single spore cultures atomized on plants kept under bell jars. The results are summarized in Table 1.

Table 1

Fungus from	Results of inoculation on			
	Bean		Pea	
	No. of expts.	No. successful	No. of expts.	No. successful
Bean	9	9	13	2
Pea	25	2	7	5

In the two successful inoculations with the bean *Ascochyta* on pea, pycnidia appeared only in one, and these contained large spores characteristic of the bean *Ascochyta*, from which typical cultures were obtained. In the two successful inoculations with the pea *Ascochyta* on bean, only one showed pycnidia, and these had spores characteristic of *A. pisi*. An attempt to make artificial cultures from them failed owing to bacterial contamination.

Inoculations were also carried out on plants in the field, but with negative results, and also with seeds afterwards sown in pots and compared with plants from uninoculated seeds, with the result shown in Table 2.

Table 2

Fungus from	Successful inoculation on	
	Pea	Bean
Pea	1 out of 1	0 out of 3
Bean	0 out of 5	1 out of 3

The results of Sprague (1929) and Ratschlag (1930), who carried out similar cross-inoculation experiments, are summarized in Table 3.

Table 3

Sprague (1929) Fungus from	Successful inoculation experiments on Bean	
Pea	3 out of 12	
Bean	2 out of 3	

(Ratschlag (1930) (100 plants in each experiment)

Fungus from	Percentage successfully inoculated on	
	Pea	Bean
Pea	75	25
Bean	12	80
Bean	15	60

Other workers regard the bean fungus as completely specialized on its host. Ludwig (1928) obtained only a few black spots when he inoculated broad bean with *A. pisi* from peas. Bondartzeva-Monteverde & Vassilievsky (1940) obtained only very slight traces of infection by *A. fabae* on plants other than the broad bean and Yu (1947) also reported no infection on pea and other legumes.

Thus, experience shows that *A. fabae* is largely specialized to bean: artificial inoculations readily take on bean but not on other legumes. In the few instances when lesions were developed on pea, the fungus retained its specific character and was quite distinct from *A. pisi*. Ratschlag (1930) claimed that spores of *A. fabae* were smaller when inoculated on pea than on bean, and similarly spores of *A. pisi* were larger on bean than on pea. It is doubtful if these differences in spore size were significant, particularly as Sattar (1934) has observed that spore size is often affected by moisture and other factors, and in any event they were well within the range of each species. I conclude therefore that *A. fabae* Speg. should be retained as the correct name of the bean fungus.

CONTROL MEASURES

The only satisfactory method of control is the use of clean seed. Small-scale experiments with proprietary mercury seed disinfectants have shown that they do not prevent the appearance of *A. pisi* on peas, and the same is likely to hold for beans. The disease is much more likely to occur on autumn-sown beans than in those sown in February or March. Wet weather in the growing season is also very favourable; a dry spring completely checks the disease.

SUMMARY

Ascochyta spot disease of broad beans, first observed in 1927 in England, is widely distributed throughout the world, but rarely causes appreciable economic damage. The fungus is closely related to *Ascochyta pisi*, but is distinct, and can be readily differentiated by the larger size of its spores. It is largely specialized in its parasitism to broad bean, and in the small



Fig. 2



Fig. 1

number of inoculation experiments in which peas were successfully inoculated the fungus retained its specific character on this host. It is therefore best regarded as a distinct species, *A. fabae* Speg. The disease is carried on the seed and the only satisfactory preventive measure is to use clean seed harvested from healthy crops.

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EXPLANATION OF PLATE 27

- Fig. 1. *Ascochyta fabae* leaf spot on broad bean, Newton Abbot, Devon, 7 May 1930.
- Fig. 2. *A. fabae* pod spot on broad bean, Newton Abbot, Devon, 8 August 1931.

(Accepted for publication 16 January 1950)

A NOTE ON *CHROMOCREA SPINULOSA* (FUCKEL) PETCH N.COMB.

BY F. T. BROOKS AND JEAN MATHIESON

Botany School, University of Cambridge

Chromocrea spinulosa was isolated from dead culms of *Dactylis glomerata* at Cambridge by Dr E. G. Bollard in December 1945, and was identified by the late Mr T. Petch. It is purely saprophytic.

It belongs to the Hypocreaceae as the perithecia are light coloured and develop in a cushion-like stroma. Stromata are produced abundantly in cultures on malt agar. At first they are pale buff coloured, about 1–3 mm. in diameter. Later the surface of the stroma becomes dotted with the ostioles of the immersed perithecia; each ostiole is surrounded by a narrow zone of dark green hyphae so that the surface of the stroma appears to be covered with blackish dots. As the perithecia mature the tissue around the ostiole proliferates and forms a small projection. The green pigment is restricted to the tissue immediately surrounding the ostiole and is not present in the perithecial wall which is persistently yellow. The perithecia are flask-shaped, 140–160 μ long and 90–110 μ wide at the greatest diameter. The asci are cylindrical, 70–85 $\times$ 4 μ . Initially there are eight ascospores, but each is subsequently divided by a septum so that there are sixteen free spores at maturity. The two parts of each original spore differ slightly in size and shape, the upper part being approximately cubical and the lower one obovate. In addition to this variation in size and shape between the two cells of the original spores, there is a difference between the two-celled spores themselves, four being larger than the rest. This character segregates in the ascus as if it were controlled by a pair of allelomorphs. The large two-celled spores measure 6.5–9 $\times$ 3 μ , and the small ones 5–6 $\times$ 2.5–3 μ . The spores are clear green under the microscope and dark green in the mass. At maturity they are forcibly ejected from the perithecia. There are no paraphyses or conidia. *Chromocrea spinulosa* is very useful for teaching purposes on account of the abundance of perithecia in cultures. One of us (J. M.) has used it for genetical investigations, the results of which will be published elsewhere.

This fungus was first described by Fuckel in 1869 as *Hypocrea spinulosa*. He described the perithecia as black, but he probably based this statement on the colour of the tissue surrounding the ostioles, which does appear black in reflected light. He stated that the spores were pale yellow, but made no mention of dimorphism. It was recorded as growing on rotting stems of *Chelidonium majus* at Mühlberg, bei Oestrich, Germany. Karsten (1873 p. 206) recorded it in Finland.

The present note is apparently only the third record of the species and the first in this country. The late Mr Petch wrote to one of us that it should be transferred to the genus *Chromocrea* on account of its coloured spores; it should therefore be cited as ***Chromocrea spinulosa*** (Fuckel) Petch

Chromocrea spinulosa. *F. T. Brooks and Jean Mathieson* 351

n.comb., syn. *Hypocrea spinulosa* Fuckel. Petch's microscope slide of the fungus is deposited in the British Museum (Natural History) together with his other collections.

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OPHIOBOLUS GRAMINIS SACC. VAR. AVENAE

E. M. TURNER IN MID-WALES IN 1948

By D. L. G. DAVIES

National Agricultural Advisory Service (Wales), Trawscoed,
Aberystwyth

The occurrence of Take-all in oats, wheat and barley in mid-Wales has been recorded in surveys made over many years, and on each occasion the causal organism has been shown to be *Ophiobolus graminis* Sacc. var. *avenae* E. M. Turner. In 1948, the disease attracted little attention, but following reports of widespread and destructive outbreaks in England, a survey was made to determine the incidence of the disease in the counties of Breconshire, Cardiganshire, Carmarthenshire, Pembrokeshire, Radnorshire and Montgomeryshire.

Table 1. *Ascospore measurements, in μ*

Origin of sample	Host	Mean length	Modal length	Range in length
Breconshire				
Cray	Oats	114 $\pm$ 0.9	113	84-134
Brecon	Oats	102 $\pm$ 0.9	109	84-126
Llangamarch	Oats	104 $\pm$ 0.9	98	87-124
Builth Wells	Oats	110 $\pm$ 0.8	104	91-130
Builth Wells	Barley	105 $\pm$ 0.7	102	93-130
Llanwrtyd	Barley	129 $\pm$ 0.8	130	101-141
Trecastle	Wheat	117 $\pm$ 0.7	113	104-132
Trecastle	Wheat	100 $\pm$ 0.8	102	80-119
Cardiganshire				
Crosswood	Oats	104 $\pm$ 0.8	104	93-121
Llangeitho	Oats	94 $\pm$ 1.3	87	75-119
Llanilar	Oats	100 $\pm$ 0.8	102	87-119
Llanilar	Oats	105 $\pm$ 0.7	104	87-126
Llanilar	Oats	120 $\pm$ 0.6	119	100-132
Llanilar	Oats	103 $\pm$ 0.7	98	74-119
Llanilar	Oats	99 $\pm$ 0.8	93	76-130
Llanilar	Oats	109 $\pm$ 0.8	104	91-134
Llangwryfon	Oats	100 $\pm$ 1.1	100	69-128
Llangybi	Oats	92 $\pm$ 1.1	87	82-130
Llandyssul	Oats	104 $\pm$ 0.8	103	87-130
Llandyssul	Oats	109 $\pm$ 1.1	98	91-132
Llanybyther	Oats	142 $\pm$ 0.9	141	113-169
Ffostrasol	Oats	123 $\pm$ 0.9	124	97-143
Llanilar	Barley	113 $\pm$ 0.9	110	93-132
Carmarthenshire				
Llangadock	Oats	99 $\pm$ 0.7	98	78-113
Llangadock	Oats	111 $\pm$ 1.1	109	91-135
Carmarthen	Wheat	106 $\pm$ 0.7	109	93-115
Carmarthen	Barley	127 $\pm$ 0.9	125	106-165
Radnorshire				
Nantmel	Oats	108 $\pm$ 1.0	109	76-130
Nantmel	Oats	108 $\pm$ 0.8	104	89-130
Nantmel	Oats	121 $\pm$ 0.8	124	97-163
Llanyre	Oats	109 $\pm$ 0.9	113	80-126
Pembrokeshire				
Letterston	Wheat	109 $\pm$ 0.6	109	96-122

Samples of oat, wheat and barley stubble were collected from fields chosen at random after harvest, and were examined in the laboratory for the presence of perithecia and hyphal plates. A total of ninety samples was examined, of which thirty-two bore perithecia and sixteen hyphal plates only. In view of the need expressed by Garrett & Dennis (1943) for ascospore measurements on wheat and barley from mid-Wales, measurements of 100 ascospores were made from each of twenty-four samples of oats and four samples of wheat and barley; the spores were taken from groups of perithecia from several tillers in each sample.

Mean ascospore length varied from 92 to 140 μ (Table 1), which is considerably greater than that found by Turner (1940) and Garrett & Dennis (1943). Modal length was extremely variable within the range 87–141 μ . Further support is given, however, to Turner's separation of *O. graminis* var. *avenae* from *O. graminis* proper. In view of the extensive range shown in spore length a study was made of the range occurring within single perithecia and asci. For this purpose, fifty ascospores were measured from each of eight perithecia chosen at random out of the total samples, and the spores from six asci were also measured. The data obtained shows that the greatest range in spore length occurring within a single perithecium, viz. 80–130 μ (Table 2) was exceeded in only six spore counts shown in Table 1, and is equal to half the extreme range, viz. 69–169 μ , of all the samples. Within single asci a range of 32 μ in spore length was found (Table 3).

Table 2. *Ascospore measurements from single perithecia, in μ*

Perithecium	Mean length	Modal length	Range in length
1	98 $\pm$ 1.0	98	78–113
2	115 $\pm$ 1.1	117	100–132
3	112 $\pm$ 1.5	119	87–130
4	111 $\pm$ 1.3	108	80–130
5	109 $\pm$ 1.1	108	91–130
6	114 $\pm$ 1.0	112	96–129
7	114 $\pm$ 1.0	112	93–132
8	129 $\pm$ 1.1	130	101–141

Table 3. *Range in length of ascospores from single asci, in μ*

Ascus	
1	87–109
2	87–119
3	96–118
4	100–119
5	111–121
6	114–121

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STUDIES ON BRITISH CHYTRIDS

XI. *CHYTRIDIUM OEDOGONII* COUCH.

By HILDA M. CANTER*

*Freshwater Biological Association, Wray Castle, Ambleside; and
Department of Botany, Birkbeck College, University of London*

(With Plates 28 and 29 and 3 Text-figures)

CHYTRIDIUM OEDOGONII

Chytridium oedogonii, described by Couch (1938) from Mountain Lake, Virginia, U.S.A., was found on *Oedogonium* filaments attached to reed stems in Blelham Tarn during March 1949. Other samples were collected from Esthwaite Water and Windermere (North basin) in July, from Derwentwater in August and Loweswater in September of the same year. All these localities are in the English Lake District.

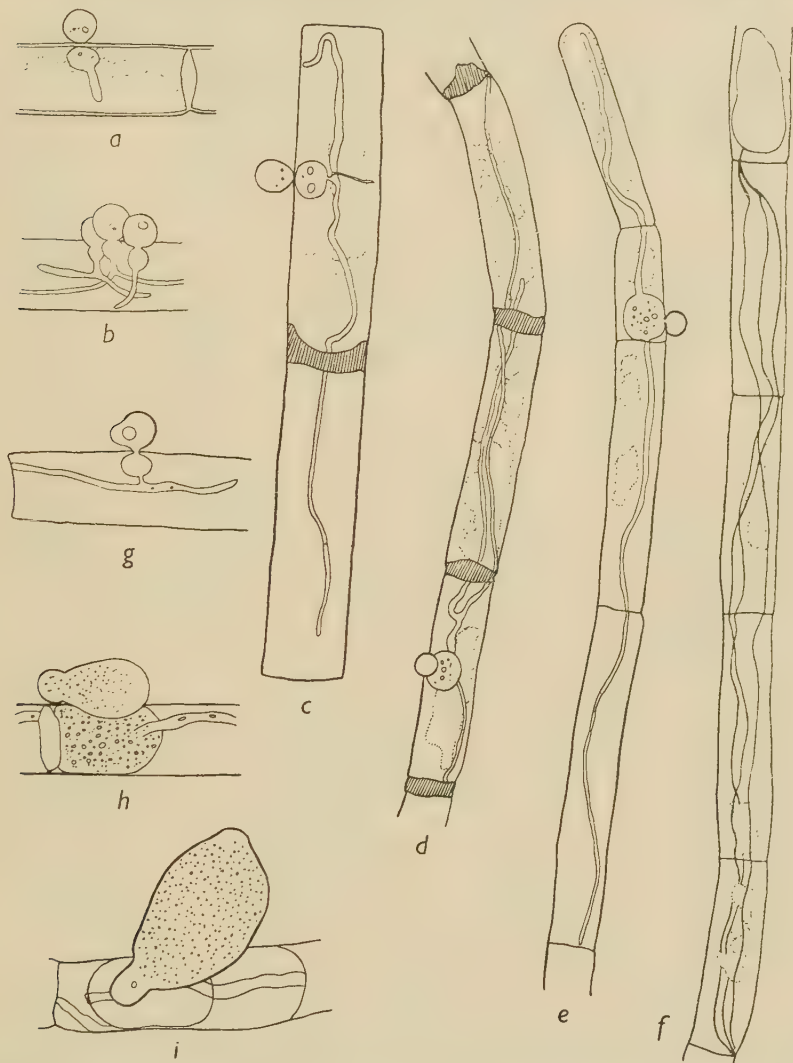
In the main features of structure and development the British material agrees with the figures and description given by Couch. Couch makes no reference to the mode of life of *Chytridium oedogonii*, but from my observations it appears to be saprophytic. In the British material there is no thickening of the host cell wall at the point of entry of the germ tube from the zoospore, although thickening of the transverse septa of the host filament does occur. The intramatrical vesicle may be spherical, $6\ \mu$ in diameter, but it is more often oval ($7.5\text{--}12.5 \times 16\text{--}22\ \mu$) (Text-fig. 2 *k, m, o, p*). The rhizoidal system which arises from the vesicle, consists of long threads (up to $195\ \mu$ long by $2\text{--}5\ \mu$ broad) which branch rarely and do not taper (Text-fig. 1 *d-f*). The sporangium shows a range of size from $7.5\text{--}16\ \mu$ broad to $14\text{--}45\ \mu$ high. Occasionally very small ones, $3.5\ \mu$ broad by $4.2\ \mu$ high, were seen. These liberated only a very few zoospores and appeared to develop in host cells which were already infected and apparently drained of most of their nutriment. Spore liberation was observed on a few occasions. The zoospores were fully formed within the sporangium and emerged singly and slowly through the orifice left after detachment of the lid (Text-fig. 2 *e*).

Each zoospore remains for a few seconds at or near the sporangium mouth before rounding off and swimming away. The zoospore ($5\text{--}5.5\ \mu$ diameter) has a large postero-lateral refractive globule (rarely two smaller ones) and a single posterior flagellum. The lid is well developed and often persists attached to the side or in the mouth of the empty sporangium (Text-fig. 2 *e, f*, and Pl. 28, fig. 6).

Resting spores were very common. The young spore contains numerous small refractive globules, but by the time it is mature these have usually coalesced to form one to four larger globules (Text-fig. 3 *c-f* and Pl. 29, figs. 1-3). As well as the spherical or slightly flattened resting spores ($10\ \mu$ high by $15\ \mu$ long), similar to the one pictured by Couch (1938,

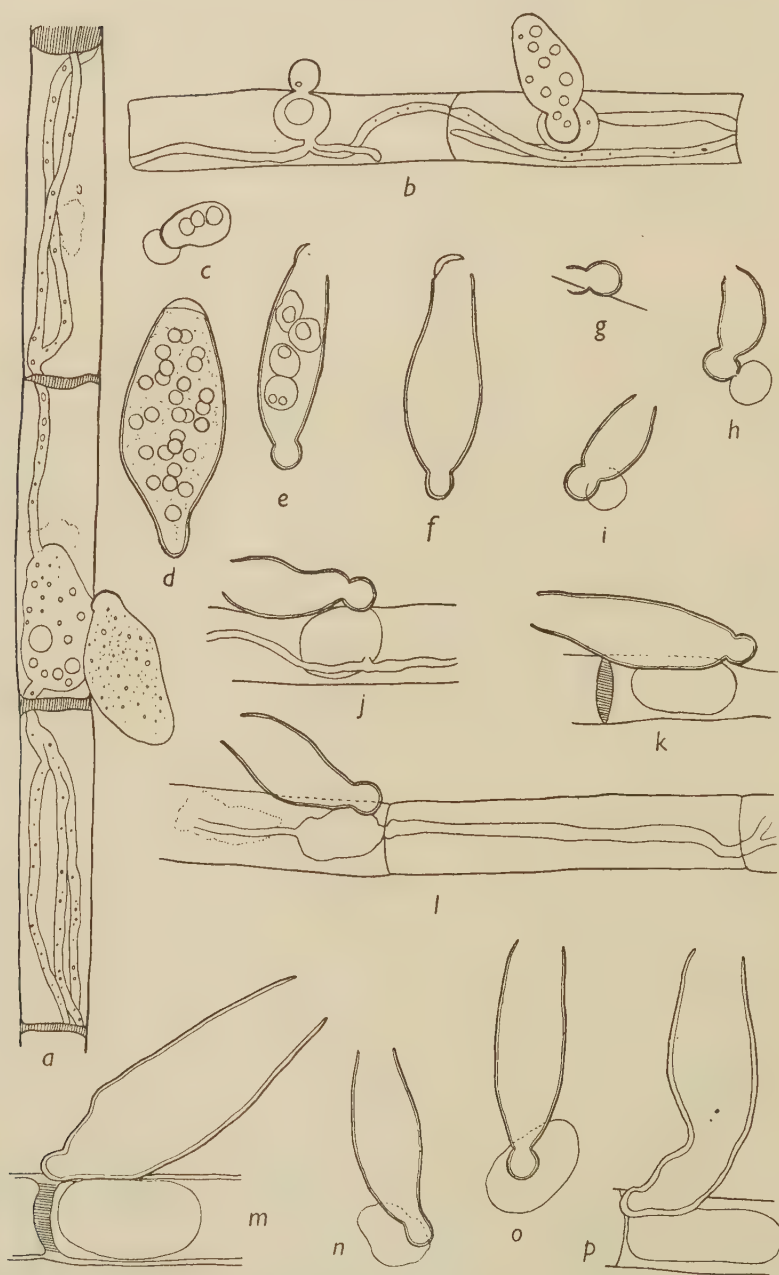
* Mrs J. W. G. Lund.

fig. 16), I observed many longer specimens (up to $31\ \mu$ long) occupying the whole breadth of the host cell (Text-fig. 3 *d, f*). One very long spore ($10.5 \times 48\ \mu$) contained five large refractive globules. The wall of the mature resting spore is thick, smooth and hyaline to a yellowish brown.

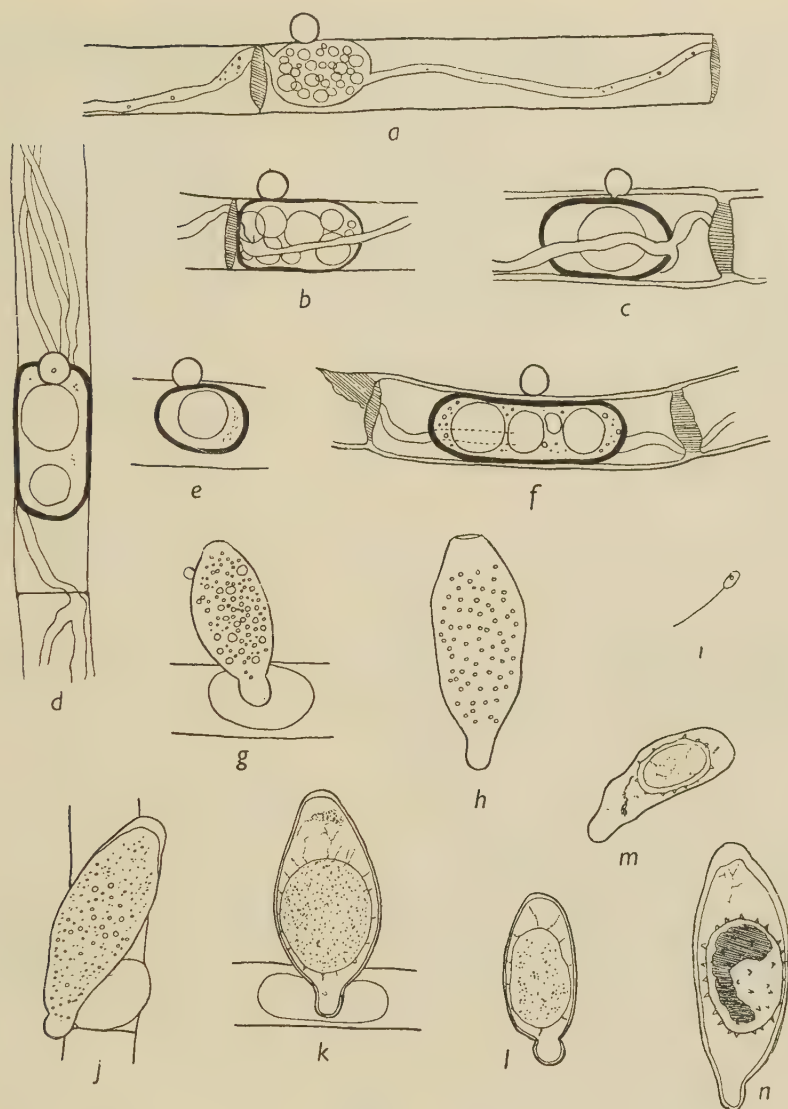


Text-fig. 1. *Chytridium oedogonii*. *a-i*, stages in the development of the sporangium. *f*, prosperangium with a part of the rhizoidal system which consists of three parallel threads. Thickening of the host wall is shown by cross-hatching. *a-c, g-i*, $\times 800$; *d-f*, $\times 500$.

The rhizoidal system in all respects resembles that associated with the sporangium (Text-fig. 3 *a-f*). The persistent zoospore cyst remains visible and connected with the resting spore even after disintegration of the host cell. So far I have been unable to germinate the resting spore.



Text-fig. 2. *Chytridium oedogonii*. *a*, immature thallus. *b*, two thalli, one very young the other almost mature. *c*, *d*, mature sporangia. *e*, dehiscent sporangium with zoospores. *f*–*p*, empty sporangia showing range of size and form. All $\times 800$.



Text-fig. 3. *Chytridium oedogonii*. a, b, young resting spores. c-f, mature resting spores. *Rozella* sp. g, infected sporangium of *Chytridium oedogonii*; empty zoospore case of parasite clearly visible. h, mature sporangium. i, a zoospore. j, sporangium of *C. oedogonii* in which a resting spore of *Rozella* will develop; note the thickened apex of the sporangium. k, l, immature resting spores with hyaloplasmic strands. m, n, spiny, mature resting spores; in (m) the hexagonal ridges are indicated by dotted lines. All $\times 800$.

AN ENDOPARASITE OF *CHYTRIDIUM OEDOGONII*

A parasite was frequently found in *C. oedogonii*, but few details of its life history were determined. However, there is sufficient evidence to show that it is a species of *Rozella*. Empty zoospore cases of the parasite could

sometimes be found on the infected *Chytridium* cells (Text-fig. 3 *g*) which seem to be fully grown sporangia, and, as far as I could see, no hypertrophy occurred as a result of infection. Infected sporangia are easily recognized by the unusual appearance of the protoplasm in which numerous moving granules are to be seen. The parasite, in the early stages, does not seem to have a limiting membrane, but finally it occupies the whole sporangium of the host, and the wall of the parasite is closely applied internally to that of the host. The lid of the host sporangium develops, although somewhat abnormally, but it is finally pushed off and the small zoospores of the parasitic chytrid together with extraneous host globules exude into the external medium. The zoospores are oval in shape with a small anterior globule.

An infected sporangium of *C. oedogonii*, which will later contain a resting spore of *Rozella*, is early recognized by its thickened apex (Text-fig. 3 *j*). During development the protoplasm of the parasite appears to concentrate in a ball towards the centre of the infected cell with protoplasmic strands radiating outwards from its surface (Text-fig. 3 *k, l*). At first no definite membrane is visible, but later a wall is formed beset with short spines and hexagonal ridges (Text-fig. 3 *m, n* and Pl. 29, fig. 5). The content of the mature resting spore consists of a mass of a dully refractive substance.

My especial thanks are due to Mr Willoughby who gave me the material he collected from Blelham Tarn upon which the main descriptions in this paper are based, and also for the observations and measurements he made on this fungus. Prof. C. T. Ingold I thank for reading the manuscript.

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EXPLANATION OF PLATES 28–29

PLATE 28. *Chytridium oedogonii* Couch ($\times 1550$.)

- Fig. 1. Young thallus, thread-like rhizoid clearly seen in lower cell.
 Fig. 2. Early stage showing young sporangium budding out from zoospore case.
 Fig. 3. Sporangium (out of focus) with elongate prosperangium.
 Fig. 4. Immature sporangium.
 Fig. 5. Empty sporangium.
 Fig. 6. Empty sporangium with operculum.

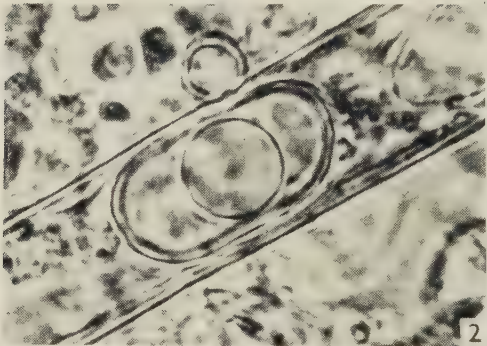
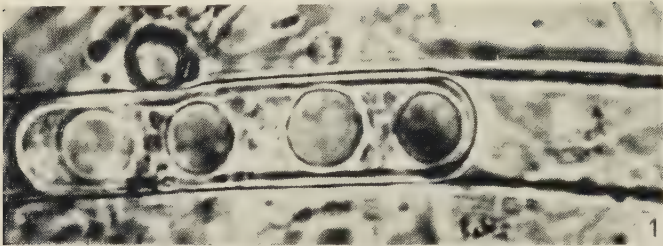
PLATE 29

- Figs. 1–3. Mature resting spores of *C. oedogonii*. ($\times 1550$.)
 Fig. 4. (*y*), a small empty sporangium of *C. oedogonii*. (*z*), small sporangium with resting spore of *Rozella* sp. ($\times 1620$.)
 Fig. 5. Mature resting spore of *Rozella* sp. ($\times 1580$.)

(Accepted for publication 25 February 1950)



Figs. 1-6



Figs. 1-5

ELECTRON MICROGRAPHS OF SPORES OF SOME BRITISH GASTEROMYCETES

BY P. H. GREGORY AND H. L. NIXON

Rothamsted Experimental Station, Harpenden, Herts

(With Plates 30 and 31)

With the light microscope the surface of spores of puff-balls and earth stars appear either smooth as in *Bovista*, acutely or obtusely warted, or echinulate as in many species of *Lycoperdon* and *Geaster*. The spores are usually between 3 and 5 μ in diameter, and details of their surface ornamentation are beyond the limit of resolutions of the light microscope. To obtain information on the aerodynamic properties of these spores the greater resolving power and depth of focus of the electron microscope have been used to show details of surface contour. The pictures obtained by this method may also help to clear up some systematic puzzles. Electron micrographs of five species of fungi, including *Bovista nigrescens*, have been published by Favre, Kellenberger & Weigle (1948).

The specimens from which spores were taken for examination are listed on pp. 362-3, and electron micrographs of one or more spores of each of the species examined are shown in Pls. 30 and 31 at a magnification of 5000 diameters. The nomenclature followed is that of Rea (1922).

All the electron micrographs were made with a 50 kV. electron beam in an RCA type B microscope equipped with a self-biased gun and objective pole-piece compensated for astigmatism by the method of Hillier & Ramberg (1947). The magnification on the plate was generally about 3500, and in order to secure this low magnification without severe distortion the normal protector pole-pieces were removed and in their place were fitted the objective pole-pieces originally supplied with the instrument. The lower limit of magnification for a reasonably distortion-free picture 2 in. square is about 2000 times with this arrangement.

The spores were mounted by embedding them in the collodion supporting film, because preliminary trials showed that if merely deposited on the film the spores would always fly off under the influence of electrostatic charges. The embedding was done by dusting the spores over the surface of a clean glass slide and then flooding the surface of the slide with a solution of celloidin in amyl acetate. When the films had dried they were stripped off the glass on to a water surface and mounted on grids in the usual way. The resulting mounts generally showed only two or three spores in each grid aperture, and experience indicated that this density could not be exceeded with such large objects without causing movement of the specimen or premature breakage of the supporting film.

ARTEFACTS PRODUCED BY ELECTRON BOMBARDMENT

When the condenser lens was adjusted to focus an image of the source on the specimens, the very intense electron bombardment caused a series of changes to take place in the appearance of the spores. The first stage is a sudden shrinkage, without any other visible change, and is illustrated in Pl. 30, figs. 3, 4, which show a spore of *Lycoperdon saccatum* before and after intense irradiation. No changes in shape were ever seen to accompany this first stage, and the reduction in linear dimensions is usually about 10 %. We suggest that it corresponds to drying the spores by heating in the electron beam.

The second stage causes a much more serious alteration in the appearance of the spores, and could only be brought about by exposure of groups of spores to the full intensity of the electron beam. The warts are greatly reduced both in size and in number, and the whole spore becomes transparent to the beam, showing variations in density which may possibly correspond to internal structure (*Lycoperdon echinatum*, Pl. 30, figs. 5, 6). We suggest that this second stage corresponds to the incineration of the spores in the electron beam. These effects can only be produced when the maximum intensity is deliberately focused on to the specimens, and we have no evidence of any alteration in size or shape caused by exposure to vacuum or to electron bombardment at the intensities used to prepare the remainder of the micrographs. In all the electron micrographs warts are shown in profile, the tops of other warts can be seen projecting in part profile owing to the great depth of focus of the instrument, but the low penetrating power of the 50 kV. electron beam used makes it impossible to see the warts from above. The projections on the spore-walls of most of the species examined are of a basically uniform type. *Lycoperdon giganteum*, *L. caelatum*, *L. pyriforme*, *Bovista plumbea* and *B. nigrescens* normally appear smooth under the light microscope and are so described in most systematic works, but Carleton Rea (1922) and Coker & Couch (1928) describe *Lycoperdon giganteum* as verrucose or very minutely warted (see Pl. 30, fig. 1). Coker & Couch also state that *Bovista plumbea* is very minutely warted with a halo around the spore. Of the species examined only *Lycoperdon caelatum* appeared approximately smooth in the electron microscope, and even this was distinctly rougher than the spores of the unidentified fungus from sycamore, described by Gregory, Peace & Waller (1949) shown in Pl. 31, fig. 9, for comparison. This is evidence against the possibility that some of the projections observed are in fact shrinkage artefacts produced by exposure of the spores to high vacuum and electron bombardment.

The spore of *L. giganteum* appears angular because it bears relatively few widely separated flat conical warts. *Bovista plumbea* and *B. nigrescens* are densely covered with small conical warts.

The spores of other species of *Lycoperdon* and *Bovista* are closely set with warts projecting about $0.5\ \mu$ from the wall. The basic pattern of a wart seen in profile on the periphery of the spore is a truncated cone of angle about $45-70^\circ$ at the base, capped with a shorter, flatter cone of angle about 20° at the base. The bottom of the capping cone may be wider than the

truncated top of the cone on which it is seated (Pl. 30, fig. 3) and the junction of the two cones may be rounded (Pl. 30, fig. 9) or terraced (Pl. 30, fig. 15; Pl. 31, figs. 3, 5).

Spores which have been stored for a long time in the herbarium tend to be small. Persoon's specimen of *Geaster bryantii* from the Kew Herbarium, for example, is both the oldest and the smallest examined.

The fragile, deciduous sterigma, of *Lycoperdon echinatum* or *L. umbrinum* is seen to be flattened up to the point where it joins the persistent pedicel (Pl. 30, figs. 10, 12); it may be twisted into a flattened counter-clockwise helix (Pl. 30, fig. 13). The long pedicels on the spores of *Bovista plumbea* and *B. nigrescens* appear to be normal distended hyphae.

Groups of two or three adherent spores are shown in *Lycoperdon echinatum* in Pl. 30, fig. 9; *Geaster bryantii*, Pl. 31, fig. 1, and *G. fimbriatus*, Pl. 31, fig. 8. In all these the spores are seen to be held in contact by warts joined tip to tip like the perforations on a postage stamp. This suggests the hypothesis that the warts are formed by the drying and shrinkage of a gelatinous film deposited on the original wall of the spore as the fruit body matures.

It has long been known (de Bary, 1884) that in the Lycoperdaceae, after the formation of spores, the hymenial system of the gleba becomes gelatinized and finally disappears completely. Evaporation of water from the surface of the fruit body leaves the spores as a dry powder in chambers containing the dark hyphae of the capillitium.

Thickening of the spore wall may well be a secondary phenomenon. Swartz (1933, p. 418) states that in *Bovista plumbea* 'sometimes before detachment, sometimes after, the spore wall is thickened and assumes a golden brown colour'. It is suggested that during the disintegration of the gleba a gelatinous film coats the spores, shrinking and cracking into columns as it dries, thus forming the basal cones of the warts. The flatter apical cones on the warts may then represent the points where the film is stretched apart and finally broken as adjacent spores separate. The material composing the warts is highly resistant, even to cold concentrated sulphuric acid. If it is in fact chitin, the gelatinization of the cell walls of the gleba is probably not a hydrolysis, as it is unlikely that chitin would be resynthesized outside the cell.

A phenomenon that may possibly be connected with the gelatinization process is shown in Pl. 30, fig. 12, where a spore from an immature fruit body of *Lycoperdon umbrinum*, collected before the formation of the ostiole, is surrounded by a number of small regular disk-like bodies, about $0.15\text{--}0.2\ \mu$ in diameter. They have been found in other immature specimens of *L. echinatum* and *L. umbrinum*, and possibly also in a mature specimen of *L. giganteum*. The nature of these bodies is unknown; they might conceivably be particles of chitin, derived from the gleba, that would ultimately be deposited around the spores as the specimen matured.

SUMMARY

Spores of some British Gasteromycetes have been examined with the electron microscope. The increased resolving power and great depth of focus enable details of the surface ornamentation to be studied, but the low penetrating power of the 50 kV. electrons used does not permit any internal structures to be seen. The spores of some species which were previously described as smooth are shown to be warted, and the warts on all species examined appear to conform to the same basic pattern. This consists of a low truncated cone having an angle of $45-70^\circ$ capped by a much flatter cone, the shape of which varies among the different species. To account for the formation and shape of the warts, and also for the presence of circular disks about 0.2μ diameter, sometimes observed in mounts from immature specimens, it is suggested that, during the disintegration of the gleba, the spores are coated with a gelatinous film which shrinks and cracks while drying.

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EXPLANATION OF PLATES 30 AND 31

PLATE 30
(Magnification $\times 5000$.)

- Fig. 1. *Lycoperdon giganteum*. Gustard Wood, Herts, September 1944. (P. H. G.)
- Fig. 2. *L. caelatum*. (H. K. Airy Shaw, 1946), det. R. W. G. Dennis, Herb. Kew.
- Figs. 3, 4. *L. saccatum*. Harpenden, Herts, September 1945. (P. H. G.)
- Fig. 5. *L. perlatum*. Harpenden, 1950. (P. H. G.)
- Fig. 6. *L. perlatum*. Whitby Foray, September 1946. (P. H. G.)
- Fig. 7. *L. velatum*. Worcester, 1933. (E. J. H. Corner), det. C. Rea, Herb. Kew.
- Fig. 8. *L. pyriforme*. East Malling, October 1944. (P. H. G.), det. R. W. G. Dennis.
- Fig. 9, 10. *L. echinatum*. Goodwood 1945? (R. W. G. Dennis.) (The spore in fig. 10 is the upper spore in fig. 9.)
- Fig. 11. *L. umbrinum*. North Bull Is. Dublin, 1949. (Hassell), Herb. Kew.
- Figs. 12, 13. *L. umbrinum*. Simonshyde Wood, Herts, October 1945. (P. H. G.)
- Fig. 14. *L. spadiceum*. Harpenden, February 1945. (P. H. G.), det. E. M. Wakefield.
- Fig. 15. *L. spadiceum*. Southborough, Tunbridge Wells, Kent, September 1944. (P. H. G.), det. E. M. Wakefield.
- Fig. 16. *L. atropurpureum*. Lilley Hoo, Herts, July 1946. (P. H. G.)
- Fig. 17. *Bovista plumbea*. St Martins, Scilly, December 1947. (P. H. G.)
- Fig. 18. *B. nigrescens*. Rothamsted, May 1944. (P. H. G.), det. R. W. G. Dennis.





Figs. 1-16

PLATE 31
(Magnification: $\times 5000$.)

- Fig. 1. *Geaster bryantii*. Boxhill, 1947. (Green), Herb. Kew.
Fig. 2. *G. limbatus*. Upper Hellsdon. (E. A. Ellis), det. R. W. G. Dennis, Herb. Kew.
Figs. 3, 4. *G. umbilicatus*. St Martins, Scilly. December 1947. (P. H. G.), det. E. M. Wakefield.
Figs. 5, 6. *G. fimbriatus*. East Malling, October 1944. (P. H. G.)
Figs. 7, 8. *G. fimbriatus*. Box Hill, October 1927. (M. L. Green), Herb. Kew.
Fig. 9. Spores of unidentified fungus from sycamore (p. 360).
Fig. 10. *G. triplex*. Box Hill, October 1938. (M. L. Green), Herb. Kew.
Fig. 11. *G. rufescens*. Persoon's specimen in Herb. Kew.
Figs. 12, 13. *G. rufescens*. Lubbenham, 1881. (Ashton), det. M. J. Berkeley, Herb. Kew.
Fig. 14. *G. coronatus*. Box Hill, 1930. (M. L. Green), Herb. Kew.
Fig. 15. *G. fornicatus*. Mousehole, Glam., 1948. (Jenkins), Herb. Kew.
Fig. 16. *Astraeus hygrometricus*. Totnes, 1922. (Mrs May), Herb. Kew.

(Accepted for publication 27 February 1950)

PROCEEDINGS, 1949

MEETINGS

Meeting held in the Department of Botany, Imperial College of Science and Technology, London, at 11.0 a.m., 29 January 1949. The President, Dr. W. P. K. Findlay, in the Chair.

Culture Collections

- G. SMITH. The history of culture collections.
 H. A. DADE. The Commonwealth Mycological Institute culture collection; organization and problems.
 G. PONTECORVO. Genetical aspects of strain conservation.
 H. PROOM. The preservation of micro-organisms by freeze-drying.
 J. G. MANNERS. The establishment and maintenance of pure cultures of Rust fungi.
 E. C. BADCOCK. Culture of wood-destroying fungi.
 G. C. AINSWORTH. Culture of Dermatophytes.

Meeting held in the Department of Biology, Chelsea Polytechnic, London, at 11.30 a.m., 12 March 1949. The President, Dr W. P. K. Findlay, in the Chair.

Phycomycetes

A demonstration of fungi belonging to the Phycomycetes, with exhibits and comments by:

- Miss H. CANTER. Chytridiales and other Phycomycetes from aquatic habitats.
 W. R. IVIMEY COOK. Members of the Plasmodiophorales.
 Miss E. M. BLACKWELL and students of Royal Holloway College. Stages in the life-history of *Blastocladia pringsheimii* and of *Phytophthora cactorum*; *Pythiomorpha*; a collection of species of *Phytophthora* from water; haustoria and 'diverticula' in *Phytophthora infestans*.
 Miss A. GODWIN. Haustoria in *Phytophthora infestans*.
 Miss V. M. OSTERBURG. *Spongospora* sp. in watercress.
 Miss B. BRADY. *Pythium undulatum*, and a collection of species of *Saprolegnia* and *Achlya* made by Miss E. K. GOLDIE SMITH.
 Miss G. M. WATERHOUSE. Cultures of some British species of *Phytophthora*.
 J. A. TOMLINSON. *Phytophthora porri*.
 C. G. DOBBS. Uncommon Zygomycetes.
 C. L. DUDDINGTON. Zygomycetes—Zoopagaceae.
 C. G. C. CHESTERS (demonstrated by Mrs M. TURNER). Species of *Mortierella* from soil.

Meeting held at the University, Birmingham, at 11.30 a.m., 9 July 1949. The President, Dr W. P. K. Findlay, in the Chair.

- Miss M. P. ENGLISH and C. J. HICKMAN. Some observations on the biology of *Phytophthora fragariae*.
 Miss J. STAMPS. Variation in a strain of *Phytophthora cactorum*.
 Miss J. THOMPSON. *Diplodina* spp. on Larkspur and Delphinium.
 P. H. GREGORY. Trapping air-borne spores.
 Miss H. CANTER. Fungal parasitism in relation to limnology.
 Miss H. CANTER, I. J. GLEN-BOTT and C. T. INGOLD. Aerial-sporing Hyphomycetes from submerged decaying leaves.

Meeting held in the Huxley Building, Imperial College of Science and Technology, London, at 10.45 a.m., 21 October 1949. The President, Dr W. P. K. Findlay, in the Chair.

Mycorrhiza

S. D. GARRETT. The significance of mycorrhiza for the study of the root-infecting fungi.

J. L. HARLEY. Recent progress in the study of mycorrhizal relationships.

Miss J. BOURSNEILL. The symbiotic seed-borne fungus in the Cistaceae.

Miss D. G. DOWNIE. Mycorrhizal infection in relation to germination of orchid seeds.

W. R. C. HANDLEY. Some possible factors concerned in the physiology of infection by ectotrophic mycorrhizal fungi.

J. WARREN WILSON. Mycorrhizal formation in beech seedlings.

F. A. K. CLOWES. The anatomy of beech mycorrhizas.

Miss I. LEVISOHN. Pseudo-mycorrhizal infection of conifers in this country.

An account of this meeting is published in *Nature, Lond.*, **164**, 1041-2, 1949.

Meeting held in the Department of Biology, Chelsea Polytechnic, London, at 2.15 p.m., 3 December 1949. Dr J. Ramsbottom in the Chair.

G. H. BANBURY. Some aspects of phototropism in *Phycomyces*.

Miss L. E. HAWKER. Truffle hunting in the Cotswolds.

N. T. FLENTJE. Variation and specialization in the *Rhizoctonia* populations of some English soils.

ANNUAL GENERAL MEETING, 1949

The fifty-third Annual General Meeting was held in the Department of Biology, Chelsea Polytechnic, London, at 11.45 a.m. on Saturday, 3 December 1949, with the President, Dr W. P. K. Findlay, in the Chair.

After the Minutes of the previous Annual General Meeting had been read and signed the President recorded with deep regret the deaths of Miss G. Lister, Sir Rowland Biffen and Prof. René Maire. He then commented briefly on the year's activities.

The Treasurer, W. Buddin, then presented his annual statement which included an explanation of the recently introduced covenant scheme for payment of subscriptions.

The following Officers and new Members of the Council for 1950 were then elected: *President*, G. C. Ainsworth; *Vice-Presidents*, W. H. Wilkins, and the two past-Presidents, W. P. K. Findlay and A. E. Musckett; *Secretary*, C. J. Hickman; *Foray Secretary*, G. Smith; *Treasurer*, W. Buddin; *Editors*, P. H. Gregory and W. C. Moore; *Members of the Council*, J. Brooke, F. B. Hora, Miss F. Joan Moore and N. F. Robertson (to replace C. E. Foister, W. D. Graddon, P. H. Gregory and G. Smith). E. C. Large, Miss M. Noble and P. H. Williams were elected as new members of the Plant Pathology Committee.

Referring to the resignation of Dr Barnes as Editor, Dr J. Ramsbottom moved the following resolution: 'On the resignation through ill-health of Dr Barnes as Editor of the *Transactions*, the Society wishes to record its appreciation of the excellent work done by him on behalf of the Society since 1930, and to express deep regret that circumstances make it expedient for him to take this course.' The resolution was seconded from the Chair and carried unanimously.

Eight new Members were elected, making a total of fifty-five new Members and seventeen new Associates for the year.

The programme for 1950 was briefly discussed and the President informed the meeting of the provisional arrangements to hold a joint foray with the French Mycological Society in 1952.

On a motion from the Chair the following alteration in the Rules, made necessary by the introduction of the covenant scheme for payment of subscriptions, was adopted: Rule 9, for 'all members shall pay an annual subscription of one pound' read 'all members shall pay a minimum annual subscription of one pound'.

The President then outlined proposals to expand the Society's Library and to make it available to members.

A vote of thanks to the President for his services to the Society during the year, moved by E. W. Mason, concluded the meeting.

C. J. HICKMAN, *Secretary*

for the year ending 30 June 1949

£2910 5 5

Nominal values of Stock

$\left\{ \begin{array}{l} 3\frac{1}{2}\% \text{ War Stock} \\ 3\% \text{ Defence Bonds} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{£}500 \\ \text{£}200 \end{array} \right\}$
$\left\{ \begin{array}{l} 2\frac{1}{2}\% \text{ Defence Bonds} \end{array} \right\}$	$\left\{ \begin{array}{l} \text{£}500 \end{array} \right\}$
	<i>Total</i> £1200

WALTER BUDDIN, Hon. Treasurer.

Donations from numerous members to the several Funds of the Society are gratefully acknowledged.

THE WOODHALL SPA FORAY

13-15 May 1949

By G. C. AINSWORTH, *Foray Secretary*

The thirtieth Spring Foray, held at Woodhall Spa on 13-15 May 1949, was the Society's first major foray in Lincolnshire. About twenty members and students were present and facilities for the examination and display of specimens were available at St Hugh's School through the kindness of the Headmaster, Mr G. R. Forbes.

On the first day a visit was made to Fulsby and Tumby woods (situated about eight miles from Woodhall), and although the prevailing fine weather had an adverse effect on the collecting, the day was enjoyable and the display of wild lily-of-the-valley in Fulsby wood memorable. On the return journey a marsh at Kirkby-on-Bain yielded a number of additional records.

The next day, Saturday 14 May, the Society held a joint foray with the Lincolnshire Naturalists' Union, when three large parties interested in flowering plants, insects and fungi, respectively, visited Bracken Wood and the Woodhall Spa golf links. After tea in the garden of the Eagle Hotel, Prof. C. G. C. Chesters, in his capacity of President of the Lincolnshire Naturalists' Union, welcomed the Society to Lincolnshire and subsequently other speakers commented on the day's finds. In the evening a short business meeting was held with the President, Dr W. P. K. Findlay, in the chair, when votes of thanks were recorded to the various landowners for permission to visit their estates and a provisional decision made to hold the next Spring Foray at Totnes.

On the last afternoon, at the Forestry Commission's Bardney Forest conifer plantations adjoining Woodhall Spa, the aecial stage of *Coleosporium senecionis* on Scots pine and the uredial stage of the same fungus on *Senecio jacobaea* in the rides and *Mitrula paludosa* in abundance were welcome finds.

Nothing of outstanding interest was recorded during the foray. *Crepidotus pubescens* Bres. is not in the British list, although in Mr Pearson's experience it is a common species (see *Trans. Brit. mycol. Soc.* **32**, 268-269, 1950). Several other finds were new county records and the fact that the list of polypores is longer than usual for a Spring Foray must be attributed to the President's special knowledge.

The Foray Secretary records his thanks to Mr F. T. Baker and Mr A. Wokes of the Lincolnshire Naturalists' Union and to Miss G. M. Waterhouse for help in arranging the meeting. Thanks are also due to all those who contributed to the list and particularly to Mr W. D. Graddon, Mr N. F. Robertson and Mr J. Webster.

List of species

B. = Bracken Wood; *C.* = Conningsby; *F.* = Fulsby; *H.* = St Hugh's School grounds; *K.* = Kirkby-on-Bain; *R.* = Roughton Moor (Bardney Forest); *T.* = Tumbly; *W.* = Woodhall Spa.

Names without author citations for Agaricaceae are taken from Pearson & Dennis, *Trans. Brit. mycol. Soc.* **31**, 145-190, 1948, those for other Hymenomycetes and for Gasteromycetes from Rea, *British Basidiomycetae*, 1922.

BASIDIOMYCETES

HYMENOMYCETES

Armillaria mellea (rhizomorphs), *T.*
Crepidotus pubescens Bres., *W.*
Entoloma clypeatum, *H.*, *B.*
Flammula carbonaria, *C.*
Galera hypnorum, *W.*
Hypholoma fasciculare, *H.*, *B.*, *hydrophilum*, *B.*
Marasmius dryophilus, *W.*, *esculentus*, on pine cones and needles, *W.*
Panacolus papilionaceus, *H.*
Pholiota praecox, *H.*, *B.*
Pluteus cervinus, *B.*
Tricholoma gambosum, *B.*
Daedalea quercina, *T.*, *R.*
Fomes pomaceus, on hawthorn, *B.*
Ganoderma applanatum, on beech, *F.*, hawthorn, *B.*
Polyporus betulinus, *T.*, *B.*, *R.*, *dryadeus*, on oak, *B.*, *nummularius*, *T.*, *rutilans*, on oak, *sulphureus*, *H.*, *varius*, on birch.
Polystictus abietinus, on spruce, *T.*, *versicolor*, *T.*, *B.*, *R.*
Poria mucida, on oak, *W.*
Trametes rubescens, *B.*, on willow, *H.*
Stereum hirsutum, *T.*, *R.*, *H.*
Thelephora terrestris, *W.*

GASTEROMYCETES

Phallus impudicus, *T.*

UREDINALES

Coleosporium senecionis Fr., I, on *Pinus sylvestris*, II, on *Senecio jacobaea*, *R.*
Melampsora rostrupii Wagner, on *Mercurialis perennis*, *B.*
Ochropsora sorbi Diet., on *Anemone nemorosa*, *B.*
Phragmidium mucronatum (Pers.) Schlecht., II, on *Rosa*, *C.*, *violaceum* Wint., II and III, on *Rubus*, *T.*, *B.*
Puccinia aegopodii Mart., II and III, on *Aegopodium podagraria*, *W.*, *arenariae* (Schum.) Wint., III, on *Arenaria trinervia*, *T.*, *caricis* Reb., I, on *Urtica*, *K.*, III, on *Carex acutiformis*, *W.*, *fusca* Wint., on *Anemone nemorosa*, *R.*, *malvacearum* Mont., II, on *Malva*, *H.*, *mirabilissima* Peck, on *Mahonia*, *H.*, *obtegens* Tul., on *Cirsium*, *R.*, *prunispinosae* Pers., I, on *Anemone nemorosa*, *R.*, *taraxaci* Plowr., *W.*, *tragopogi* Corda, on *Tragopogon pratensis*, *W.*, *tumida* Grev., on *Conopodium majus*, *B.*
Triphragmium ulmariae Wint., II, on *Filipendula ulmaria*, *B.*
Uromyces ficariae Lév., III, on *Ranunculus ficaria*, *B.*, *poae* Rabenh., on *Ranunculus*, *W.*

USTILAGINALES

Urocystis anemones (Pers.) Wint., on *Anemone nemorosa*, *B.*
Ustilago longissima (Schlecht.) Meyen, on *Glyceria aquatica*, *K.*

ASCOMYCETES

PYRENOMYCETES

- Daldinia concentrica* (Fr.) Ces. & de Not., *T.*
Diatrype stigma (Fr.) Fr., on *Betula*, *T.*
Erysiphe graminis DC., *K.*
Eutypa flavovirens (Fr.) Tul., *T.*
Hypomyces aurantius (Fr.) Tul., on *Polystictus versicolor*, *T.*
Hypoxylon coccineum Fr., on *Fagus*, *T.*, *fuscum* (Fr.) Fr., on *Corylus*, *T.*, *multiforme* (Fr.) Fr., on *Betula*, *T.*
Leptosphaeria acuta (Fr.) Karst., on *Urtica*, *T.*, *dolioloides* (Auersw.) Karst., on *Senecio jacobaea*, *B.*, *nigrans* (Desm.) Ces. & de Not., on wheat stubble, *B.*
Melanomma pulvis-pyrius (Fr.) Fuck., on *Quercus*, *T.*, *subdispersum* Berl. & Vogl. (stat. conid. *Helminthosporium longipilum* Corda), on *Betula* bark, *T.*
Nectria cinnabarina (Fr.) Fr., on *Acer*, *T.*
Nitschkia cupularis (Fr.) Karst., on *Crataegus*, *T.*
Mycosphaerella rumicis (Desm.) Grove, on *Rumex obtusifolius*, *W.*
Phyllachora graminis (Fr.) Fuck., on *Dactylis*, *F.*
Pleospora infectoria Fuck., on *Dactylis*, *F.*
Stigmatea robertiana (Fr.) Fr., *B.*
Xylaria hypoxylon (Fr.) Grev., *H.*

DISCOMYCETES

- Ascobolus glaber* Pers., on horse dung, *K.*
Chlorosplenium aeruginosum (Fr.) de Not., on *Corylus*, *T.*
Dasyscypha albo-testacea (Desm.) Massee, on *Deschampsia caespitosa*, *calycina* (Schum.) Boud., on *Larix*, *W.*, *nudipes* (Fuck.) Sacc., on *Filipendula ulmaria*, *W.*, *soppitii* Massee, on *Quercus* leaves, *virginica* (Fr.) Fuck., on *Rubus* and *Ulex*, *W.*
Lasiobolus pilosus (Fr.) Sacc., on horse dung, *K.*
Lophodermium pinastri (Fr.) Chev., on pine needles, *T.*
Microscypha grisella (Rehm) Syd., on bracken, *T.*
Mitula paludosa Fr., *W.*, *R.*
Mollisia arundinacea (DC.) Phill., on *Phragmites communis*, *ligni* (Desm.) Karst., on oak pale, *phalaridis* Rehm, on *Phalaris arundinacea*.
Mytilidium gemmigenum Fuck., on *Larix*, *B.*
Orbilbia xanthostigma Fr., on dead wood.
Rhopographis filicinus (Fr.) Fuck., on bracken, *R.*
Rhytisma acerinum Fr., *T.*
Tapesia fusca (Pers.) Fuck., on *Calluna*, *R.*
Trichobelonium retincolum (Rabenh.) Rehm, on *Phragmites communis*.

PHYCOMYCETES

- Bremia lactucae* Regel, *H.*
Chaetocladium brefeldii v. Tieg., on horse dung, *K.*
Peronospora grisea (Unger) de Bary, on *Veronica beccabunga*, *K.*, *niessleana* Berl., on *Alliaria petiolata*, *K.*
Pilaria anomala (Ces.) Schroet., on horse dung, *K.*
Pythium undulatum Peters., on dead leaves, *F.*, *K.*

FUNGI IMPERFECTI.

- Actinothyrium graminis* Kunze, on *Arrhenatherum*, *W.*
Anguillospora longissima Ing., on horse-chestnut bud scales, *T.*
Articulospora tetracladia Ing., on dead leaves, *T.*
Clavariopsis aquatica de Wild., on horse-chestnut bud scales, *T.*
Dematium hispidulum Fr., on *Deschampsia*, *F.*
Heliscus longibrachiatus Ing., *T.*

Phyllosticta hedericola Dur. & Mont., *H.*
Spicaria elegans (Corda) Harz, on pine.
Sporodesmium paradoxum Corda, on *Betula*, *F.*
Stagonospora arrhenatheri Sm. & R., *F.*
Tetracladium marshallianum de Wild., on dead leaves, *T.*
Tetraploa aristata B. & Br., on *Deschampsia*, *B.*
Torula herbarum Link, on *Lamium album*, *W.*
Tricladium splendens Ing., on willow leaf in water.
Varicosporium elodeae Kegel, on birch leaf in water, *R.*

MYXOMYCETES

Fuligo septica Gmel.
Lycogala epidenrum Fr.
Trichia affinis de Bary.

Specimens of most of the micro-fungi listed have been deposited in the herbaria of the Commonwealth Mycological Institute, Kew; University College, Hull; the Botany School, Cambridge; and University College, Exeter.

THE OXFORD FORAY

12-19 September 1949

By G. C. AINSWORTH, *Foray Secretary*

The forty-fifth Autumn Foray was held at Oxford on 12-19 September 1949, by kind invitation of Dr W. H. Wilkins, Fellow of St Peter's Hall, who was able to arrange for headquarters and accommodation in his College. The Society is greatly indebted to the Master and Fellows of St Peter's Hall for allowing the more than ninety members and friends attending the foray to enjoy a most pleasant week of collegiate life.

The early arrivals on Monday afternoon found a fine specimen of *Asterostromella ochroleuca* Bourd. & Galz. on a piece of plank, which Mr G. C. Hughes, a Foundation Member of the Society, had brought from his home at Bicester, already on view and the walls of the workroom decorated with a representative selection of photographs by Mr S. C. Porter of the larger fungi; an exhibit which was much studied and admired. The meeting formally began with dinner in Hall with the Master and Fellows and afterwards the Master, Canon R. W. Howard, M.A., welcomed the Society and outlined the history of St Peter's Hall. Our President replied and there were other speeches.

On Tuesday, 13 September, an excursion was made to Nuneham Park where the most notable of the numerically few finds of agarics was *Hebeloma pusillum* Jakob Lange, a new British record made by Dr Morten Lange, of Copenhagen, who attended the foray as a guest of the Society. The rare *Lentinus vulpinus* was also found.

Next morning Bagley Wood was visited when *Amanita porphyria*, *Lepiota acute-squamosa* growing on sawdust, and *Cyathus striatus* were recorded. The afternoon was free for the examination of the collections and also provided an opportunity to see something of the beauties of Oxford. In the evening, the President, Dr W. P. K. Findlay, delivered his presidential address entitled 'Tree and timber fungi'.

Thursday's excursion to Blenheim Park, Woodstock, provided some of the best collecting of the week. Two parties took different routes through the extensive park when, in addition to a varied selection of the more common tree species in a good state, *Polyporus quercinus*, a great rarity, and *P. albo-sordescens* Rom. were recorded. *Doassansia sagittariae* was found in abundance, and Dr Hawker and Miss Mount unearthed *Genea hispidula* and *Tuber excavatum*, while gastronomical experiments with *Boletus satanas* by two senior members of the Society caused the Foray Secretary a certain amount of anxiety later in the day. After dinner, there was a short business meeting at which votes of thanks were passed to Oxford University, St John the Baptist College, Magdalen College, the Duke of Marlborough, and the Earl of Buckingham for allowing access to their estates, and an invitation from Dr C. G. Dobbs to hold the 1950 foray at Bangor was welcomed. On the same evening Mr John Brook and Dr Ramsbottom showed a fine

series of Kodachrome slides of larger fungi, and later in the week Dr Kurt Lowag showed similar slides of timber fungi and Austrian scenery.

On Friday, 16 September, the Plant Pathology Field Day was held at the Forest Products Research Laboratories, Princes Risborough. Those who did not attend this function spent an enjoyable and profitable time in the beech woods at Great Hampden Common on the Chiltern Hills above Princes Risborough. In the evening Mr C. E. D. Smith displayed a collection of several hundred water-colour drawings by M. C. Cooke which had recently come into his possession. The drawings which are in the style of 'Cooke's Plates', illustrate Boletaceae, Polyporaceae, Hydnaceae, Gasteromycetes, and a number of microfungi. They are thought to have been commissioned from Cooke by Miss Carlisle of Carlisle. On the same occasion Mr H. L. Nixon and Dr P. H. Gregory showed electron microscope photographs of spores of Gasteromycetes.

The last two excursions were to Wytham Park on Saturday and to Tubney Wood on the Sunday morning, while on the last afternoon Dr Wilkins conducted a tour of the Mycological Laboratories of the University Department of Botany when the work in progress was demonstrated.

Apart from a shower of rain one evening, the dry sunny weather persisted throughout the week, and although the agaric harvest was well below the average a fair and interesting collection of microfungi was made. The List, as always, also reflects the collecting bias of the members present. Discomycetes received less attention than at Belfast the previous year and, as usual since the war, no one specialized in lichens.

The Foray Secretary records grateful thanks to Dr Wilkins and his assistants for devising the attractive series of excursions, for preparing maps, and for much other guidance. He is also indebted to Mr M. B. Ellis and Dr Paul O'Connor for their assiduous attention to microfungi and for promptly supplying lists of their finds. Thanks are also due to Mr P. D. Orton and Miss G. M. Waterhouse and to all others who contributed to the records.

List of species

B. = Blenheim Park; *Bg.* = Bagley Wood; *H.* = Great Hampden Common; *N.* = Nuneham Park; *T.* = Tubney Wood; *W.* = Wytham Park.

Names without author citations for Agaricaceae are taken from Pearson & Dennis, *Trans. Brit. mycol. Soc.* **31**, 145-190, 1948, those for other Hymenomycetes and for Gasteromycetes from Rea, *British Basidiomycetae*, 1922.

* Specimen in the herbarium of the Commonwealth Mycological Institute, Kew.

BASIDIOMYCETES

HYMENOMYCETES

Amanita porphyria, *Bg.*, *B.*, *rubescens*, *H.*

Armillaria mellea, *B.*, *W.*

Clitocybe infundibuliformis, *T.*

Collybia fusipes, *N.*, *B.*, *Bg.*, *longipes*, *W.*, *maculata*, *B.*, *Bg.*, *platyphylla*, *B.*, *H.*, *Bg.*, *radicata*, *B.*, *H.*, *W.*

Coprinus atramentarius, *W.*, *domesticus*, *N.*, *ephemerus*, *lagopus*, *W.*, *micaceus*, *N.*, *B.*

Cortinarius helvelloides, *B.*

Crepidotus variabilis, *B.*, *W.*

Gomphidius roseus, *T.*

- Hebeloma pusillum* Lange, *N.*
Hypoloma candolleum, *B.*, *fasciculare*, *N.*, *Bg.*, *B.*, *H.*, *T.*
Laccaria laccata, *Bg.*
Lactarius plumbeus, *B.*, *N.*, *pyrogalus*, *W.*, *quietus*, *B.*, *vellereus*, *N.*
Lentinus vulpinus, *N.*
Lepiota acute-squamosa, on sawdust, *Bg.*, *cristata*, *W.*
Marasmius androsaceus, rhizomorphs on *Erica*, *Bg.*, *dryophyllus*, *H.*, *graminum*, *B.*,
hariolorum, *H.*, *peronatus*, *T.*, *ramealis*, *W.*, *rotula*, *Bg.*, *B.*, *W.*
Mycena acicula, *W.*, *galericulata*, *W.*, *galopus*, *B.*, *polygramma* f. *pumila* Lange, *B.*
Naucoria semiorbicularis (Bull.) Fr.
Omphalia speirea var. *tenuistipes* Lange, *W.*
Paneolus subbalteatus, *B.*
Paxillus involutus, *T.*
Pholiota mutabilis, *T.*, *spectabilis*, *N.*, *B.*
Pleurotus lepidus, *N.*, *sapidus*, *N.*, *B.*
Pluteus cervinus, *N.*, *B.*; var. *atromarginatus*, *T.*
Pluteolus reticulatus, *N.*
Psalliota arvensis, *N.*, *haemorrhoidaria*, *T.*
Psathyrella disseminata, *W.*
Psilocybe polytrichi, *B.*
Russula fallax, *foetens*, *B.*, *lepida*, *N.*, *H.*, var. *amara*, *N.*, *luteo-tacta*, *W.*, *nigricans*, *T.*,
ochroleuca.
Tricholoma flavobrunneum, *T.*, *rutilans*, *B.*, *T.*
Volvaria bombycina, *N.*
Boletus appendiculatus, *N.*, *H.*, *W.*, *calopus*, *H.*, *chrysenteron*, *H.*, *crocipodius*, *N.*,
elegans, *B.*, *W.*, *erythropus*, *B.*, *H.*, *granulatus*, *T.*, *impolitus*, *N.*, *satanus*, *B.*, *W.*,
scaber, *Bg.*, *B.*, *T.*, *W.*, *subtomentosus*, *N.*
Daedalea biennis, *N.*, *W.*, *quercina*, *Bg.*, *B.*, *H.*, *T.*
Fistulina hepatica, *N.*, *Bg.*, *B.*, *N.*, *W.*
Fomes annosus, *N.*, *ferruginosus*, *Bg.*, *fraxineus*, *N.*, *igniarius*, on willow, *N.*, *pomaceus*,
Bg., *ribis*, on hawthorn, *W.*, *ulmarius*, *N.*, *B.*
Ganoderma applanatum, *N.*, *Bg.*, on lime, *B.*
Irpex obliquus, *Bg.*, *B.*, *W.*
Lenzites betulinus, *H.*, *flaccida*, *W.*
Merulius tremelloides, *B.*
Peniophora cinerea, *Bg.*
Polyporus adustus, *B.*, *H.*, *albidus*, *albosordescens* Rom., *B.*, *betulinus*, *N.*, *Bg.*, *B.*, *T.*,
cuticularis, *N.*, *B.*, *dryadeus*, *B.*, *W.*, *giganteus*, *Bg.*, *B.*, *hispidus*, *B.*, *intybaceus*, *N.*,
nummularis, *B.*, *picipes*, *T.*, *quercinus*, *B.*, *schweinitzii*, *B.*, *squamosus*, *N.*, *B.*, *T.*,
sulphureus, *N.*, *B.*, *T.*
Polystictus abietinus, *B.*, *versicolor*, *N.*, *Bg.*, *B.*, *H.*, *W.*
Poria mollusca, *T.*, *sanguinolenta*, *W.*
Trametes gibbosa, *Bg.*, *B.*, *H.*, *mollis*, *N.*, *W.*, *rubescens*, *N.*, *Bg.*, *B.*, *W.*, *suaveolens*, *N.*
Acia uda, *W.*
Sparassis crispa, *B.*
Hymenochaete rubiginosa, *Bg.*, *B.*, *W.*
Stereum hirsutum, *N.*, *B.*, *H.*, *W.*, *T.*, *rugosum*, *H.*
Auricularia auricula-judae, *N.*, *W.*, *mesenterica*, *N.*
Calocera cornea, *B.*

GASTEROMYCETES

- Cyathus olla*, *B.*, *striatus*, *Bg.*
Lycoperdon perlatum, *Bg.*
Phallus impudicus, *N.*, *Bg.*, *B.*, *H.*, *W.*
Scleroderma aurantiacum, *Bg.*, *B.*

UREDINALES

- Coleosporium sonchi* Lév., on *Sonchus oleraceus*, *B.*, *W.*
Kuehneola albida Magn., on *Rubus*, *Bg.*, *H.*, *T.*, *uredinis* (Link) Arth., on *Rubus*, *N.**, *Bg.*
Melampsora tremulae Tul., on *Populus tremula*, *T.*
Melampsorium betulinum Kleb., on *Betula alba*, *N.*, *Bg.*

- Melampsorella symphyti Bubak, on *Symphytum officinale*, W.
 Phragmidium mucronatum Fr., on *Rosa*, Bg., H., violaceum Wint., on *Rubus*, T.
 Puccinia antirrhini Diet. & Holw., Oxford, arenariae (Schum.) Wint., on *Melandrium dioicum*, W.*, baryi Wint., on *Brachypodium sylvaticum*, T., caricis Reb., on *Carex pendula*, W., circaeae Pers., on *Circaea lutetiana*, Bg., coronata Corda, on *Arrhenatherum*, T., graminis Pers., on *Deschampsia caespitosa*, W., lapsanae Fuck., on *Lapsana communis*, T., lychnidearum Link, on *Melandrium dioicum*, W., menthae Pers., on *Mentha aquatica*, Bg.*, B., W., polygoni-amphibii Pers., W.*, pulverulentum Grev., on *Chamaenerion angustifolium*, Bg., W., scirpi DC., on *Scirpus lacustris*, W., obtegens, Tul., on *Cnicus arvensis*, Bg., B., W., violae DC., on *Viola canina*, W.*
 Puccinasterium agrimoniae Branz., on *Agrimonia eupatoria*, W., circaeae (Schum.) Speg., on *Circaea lutetiana*, Bg., pustulatum (Pers.) Diet., on *Chamaenerion angustifolium*, N.*
 Triphragmium ulmariae (DC.) Link, on *Filipendula ulmaria*, W.*
 Uromyces geranii Oth. & Wart., on *Geranium pyrenaicum*, Princes Risborough.

USTILAGINALES

- Doassansia sagittariae (Westend.) C. Fisch., B.
 Sphacelotheca hydropiperis (Schum.) de Bary, on *Polygonum hydropiper*, N.
 Ustilago longissima (Sow.) Tul., on *Glyceria aquatica*, B., succisae Magn., T., violacea (Pers.) Rous., on *Lychnis alba*, W.

ASCOMYCETES

TUBERALES

- Elaphomyces granulatus Fr., H.
 Genea hispidula Berk., B.
 Tuber excavatum Vitt., B., puberulum B. & Br., Bg.

PYRENOMYCETES

- Anthostoma turgidum (Fr.) Nits., on *Fagus*, H.*
 Anthostomella phaeosticta (Berk.) Sacc., on dead *Carex riparia* leaves, W.*
 Bertia moriformis (Fr.) de Not., W.
 Calyculosphaeria tristis (Fuck.) Fitzp., on *Acer*, B.*
 Claviceps purpurea (Fr.) Tul., on *Holcus*, T.
 Daldinia concentrica (Fr.) Ces. & de Not., on *Fraxinus*, Bg., B., N., H.*, W.
 Dialonectria sanguinea (Fr.) Cooke, on *Anthostoma turgidum* and *Diatrype stigma*, H.*, peziza (Fr.) Cooke, W.
 Diaporthe eres Nits., on *Lonicera periclymenum*, T.*
 Diatrype disciformis (Fr.) Fr., on *Acer*, T.*, on *Fagus*, B., H.*, stigma (Fr.) Fr., on *Acer*, T.*, *Crataegus*, B.*, H.*
 Diatrypella favacea (Fr.) Ces. & de Not., on *Fagus*, B.*, quercina (Fr.) Cooke, N.
 Erysiphe cichoracearum DC., on *Cynoglossum officinale*, B.*, graminis DC., on *Deschampsia caespitosa*, W., polygoni DC., on *Circaea lutetiana*, W.*, N., Bg., *Heracleum sphondylium*, T., *Hypericum quadrangulatum*, W., thortilis (Wallr.) Fr., on *Cornus sanguinea*, N.
 Gibberella zeae (Schwein.) Petch, on *Glyceria maxima*, W.*
 Gloniopsis levantica Rehm, on *Rosa*, H.*
 Hypomyces aurantius (Fr.) Tul., on *Trametes gibbosa*, H.
 Hypoxylon fuscum (Fr.) Fr., on *Corylus*, Bg., N.*, multiforme (Fr.) Fr., N., rubiginosum (Fr.) Fr., on *Fraxinus*, N.*, H.
 Lasiosphaeria hirsuta (Fr.) Ces. & de Not., on *Fagus*, B.*, *Fraxinus*, W.*, ovina (Fr.) Ces. & de Not., on *Betula*, N.*
 Lophodermium gramineum (Fr.) Chev., on *Brachypodium pinnatum*, B.*, pinastri (Fr.) Chev., B.*
 Melanconis alni Tul., on *Alnus*, B.*, stilbostoma (Fr.) Tul., on *Betula*, B.*
 Melanomma fusciculatum Sacc., on *Ulmus*, N.*, pulvis-pyrius (Fr.) Fuck., on *Fraxinus*, H.*, *Rhododendron*, B.*, subdispersum (Karst.) Berl. & Vogl., on *Betula*, N.*, B.*
 Microsphaera euonymi (DC.) Sacc., on *Euonymus europaeus*, W.
 Nectria cinnabarina (Fr.) Fr., B., T., punicea (Fr.) Fr., on *Ilex*, H.*

- Niesslia exosporioides (Desm.) Wint., on *Carex riparia*, *W.**
 Oidium quercinum Thüm., *N., H.*
 Ophiobolus eucryptus (B. & Br.) Sacc., on *Carex riparia*, *W.**
 Peroneutypa heteracantha (Sacc.) Berl., on *Acer*, *W.**, *Crataegus*, *B.**
 Phyllachora graminis (Fr.) Fuck., on *Bromus*, *T.*
 Rosellinia aquila (Fr.) de Not., on *Ulmus*, *N.**
 Sphaerotheca pannosa (Wallr.) Lév., on *Rosa*, *N.*
 Sydowiella fenestrans (Duby) Petr., on *Chamaenerion*, *H.**
 Uncinula aceris (DC.) Sacc., *N., Bg., B.**, *W., T.*
 Ustulina vulgaris Tul., on *Fagus*, *H.*
 Xylaria carpophila (Fr.) Fr., *W.*, hypoxylon (Fr.) Grev., *Bg., H.*, longipes Nits., on *Acer*, *N.** polymorpha (Fr.) Grev., *Bg., W.*

DISCOMYCETES

- Chlorosplenium aeruginosum (Fr.) de Not., *H.*
 Ciliaria scutellata (Fr.) Quél., *T.*
 Dasyscypha calycina (Schum.) Boud., *B.*
 Phacidium multivalve (DC.) Kunze & Schm., *H.*
 Pyronema omphalodes (Fr.) Fuck., *T.*
 Rhytisma acerinum Fr., *N., Bg., B., W., T.*
 Stegia ilicis Fr., *H.*

PHYCOMYCETES

- Gonapodya prolifera (Cornu) Fisch., on *Alnus* leaves in water, *B.*
 Peronospora chenopodii Gäum., on *Chenopodium multispermum* and *C. rubrum*, *B.*
 Piliaria anomala (Ces.) Schroet., *Bg.*

FUNGI IMPERFECTI

- Acladium conspersum Link., on *Betula* and *Fraxinus*, *N.*
 Acrothecium simplex B. & Br., on *Urtica*, *N.*
 Alternaria tenuissima (Fr.) Wilts., on *Scirpus lacustris*, *B.**
 Bispora monilioides Corda, on *Fagus*, *H.*
 Botrytis cinerea Fr., on *Rubus*, *H.*
 Brachysporium apicale (B. & Br.) Sacc., on *Fraxinus*, *N.**, bloxhami (Cooke) Sacc., on *Acer*, *N.**, *Fagus*, *H.**, obovatum (Berk.) Sacc., on *Acer* and *Fraxinus*, *N.*
 Cercospora depazeoides (Desm.) Sacc., on *Sambucus*, *N.**, *W.*
 Cladosporium herbarum Fr., on *Cirsium*, *Glyceria* and *Scirpus*, *B.**
 Colletotrichum lilacearum Ferraris, on *Scilla nonscripta*, *N.**
 Darluca filum Cast., on *Puccinia menthae*, *W.*, *Kuehneola albida*, *Bg.*
 Dendryphion comosum Wallr., on *Rumex*, *B.**, *Urtica*, *B.**, *N.**
 Epicoccum purpurascens Ehrenb. & Wallr., on *Acorus*, *Cirsium*, *Glyceria* and *Scirpus*, *B.**
 Gonytrichum caesium Wallr., on *Corylus*, *T.**, *Quercus*, *B.**, *Ulex*, *H.**
 Haplographium bicolor Grove, on *Fagus*, *H.*
 Harpographium fasciculatum Sacc., on *Acer*, *W.*
 Helminthosporium densum Sacc. & Roum., on *Sambucus*, *B.**, simplex Kunze & Fr., on *Betula*, *N.*, *Crataegus*, *H.**, *Fagus*, *B.**, smithii B. & Br., on *Ilex*, *H.**, velutinum Fr., on *Hedera*, *H.**
 Heterosporium gracile Sacc., on *Iris*, *B.*
 Isaria umbrina Wallr., on *Hypoxylon* on *Betula*, *B.**
 Libertella faginea Desm., *B.*
 Menispora ciliata Corda, on *Carpinus*, *T.**, *Quercus*, *B.**
 Myrothecium striatisporum Preston, on *Glyceria maxima* and *Scirpus lacustris*, *B.**
 Ovularia epilobiana Sacc. & Fautr., on *Epilobium hirsutum*, *W.*
 Pachnocybe clavulata Grove, on *Fraxinus*, *H.**
 Penicillium clavariaeforme Bain., on rabbit dung, *B.*
 Periconia byssoides Corda, on *Cirsium*, *Rumex* and *Urtica*, *B.**, *Epilobium*, *W.**, chlorocephala Fr., on *Epilobium*, *W.**, *Scirpus* and *Urtica*, *B.**
 Phoma urticae Sch. & Sacc., *B.*

- Polythrincium trifolii Fr., *H.*
 Ramularia calcea (Desm.) Ces., on *Nepeta hederacea*, *N.**, *W.*, cupulariae Passer., on
Inula conyza, *W.*, montana Speg., on *Epilobium montanum*, *W.*, scrophulariae
 Fautr. & Roum., on *Scrophularia nodosa*, *W.*
 Sepedonium chrysospermum Fr., on *Boletus scaber*, *W.*
 Septoria rubi Westend., *B.**
 Sporocybe flexuosa (Masse) Mason, on *Fagus*, *H.**
 Sporoschisma mirabile B. & Br., on *Fagus*, *B.**
 Steganosporium pyriforme Corda, on *Acer*, *T.*
 Stilbum tomentosum Fr., on a myxomycete on *Betula*, *N.**
 Torula herbarum (Pers.) Fr., on *Epilobium*, *W.**, *Ilex*, *H.**, *Scirpus*, *B.**, *Urtica*, *N.**,
 ovalispora Berk., on *Fraxinus*, *H.**
 Trichosporium elegans Corda, on *Fraxinus*, *H.**
 Tuberculina persicina (Ditm.) Sacc., on *Kuehneola albida*, *Bg.**
 Trichoderma viride Fr., on *Fagus*, *H.*, *T.*
 Volutella melaloma B. & Br., on *Carex riparia*, *W.**

MYXOMYCETES

(Compiled by Rev. J. H. Adams)

- Arcyria denudata Wetts., *T.*, nutans Grev., *H.*, *W.*
 Ceratomyxa fruticulosa Macbr., *Bg.*
 Comatricha (? nigra), *H.*
 Dictydium cancellatum Macbr., *Bg.*, *H.*
 Didymium difforme Duby, *B.*, squamulosum Fr., *N.*
 Hemitrichia karstenii Lister, *H.*
 Fuligo septica Gmelin, *N.*
 Physarum nutans Pers., ? *N.*
 Trichia botrytis Pers., *H.*

AUTUMN DAY FORAYS, 1949

- | | |
|--------------|---|
| 24 September | Boxhill, Surrey. |
| 9 October | Wyre Forest, Bewdley, Worcs. |
| | Oxshott, Surrey. |
| 15 October | Ruislip Woods, Middlesex. |
| | Buttercrambe Woods, Stamford Bridge, Yorks. |
| | Stoke Wood, Exeter, Devon. |
| | Cambridge. |
| 22 October | Cambridge. |

THE TWENTY-THIRD ANNUAL PLANT PATHOLOGY FIELD DAY

16 September 1949

The Twenty-third Annual Plant Pathology Field Day was held at the Forest Products Research Laboratory, Princes Risborough, by kind permission of the Director.

The large party of about seventy members and visitors was divided into four sections, and with extremely efficient organization each was conducted in turn to a selection of the departments during the course of the morning and early afternoon. In the Entomology Department the various types of insect damage in wood and timber were demonstrated and some of the research work in progress was explained. In the Anatomy Department the methods used in working out classifications of woods based on their anatomical characteristics were described and great interest was shown in their 'library' of wood blocks. In other departments the techniques used to estimate the effectiveness of new chemicals for use as protectives and the tests applied to new timbers to estimate their resistance to various forces were seen. In the workrooms the parties were shown how the Laboratory was trying to solve some of the problems encountered during the manufacture of plywood. The Society's President, Dr W. P. K. Findlay, described his department's work on Dry Rot and other fungal decays of timber; the specimens and explanatory diagrams arranged in their small museum were greatly admired. Mr Badcock showed part of his culture collection of wood-rotting fungi and some of the fructifications he had obtained.

The climax of the visit came when two films, one on Dry Rot and the other on the Death Watch Beetle were shown. These were both very much appreciated by the audience, and those members of the Laboratory who had collaborated in producing them were congratulated.

After the party had been given tea in the canteen Dr S. D. Garrett, the Chairman of the Plant Pathology Committee, on behalf of the visitors, thanked the Director and his staff for all the trouble they had taken to make the visit such an interesting and instructive one. The party dispersed at about 5 p.m.

F. JOAN MOORE
Secretary, Plant Pathology Committee

CHEESMAN AND PETHYBRIDGE BEQUESTS

The terms approved by the Council for the administration of these Bequests provide for financial help by the allocation annually of grants to enable one or more students of mycology to attend the Autumn Foray or Plant Pathology Field Meeting, who would otherwise be unable to do so. Applications from students or recommendations from Heads of Departments or members of the Society should reach the Secretary, or the Secretary of the Plant Pathology Committee not later than 1 May each year.

REVIEWS

Nomenclature of Fungi Pathogenic to Man and Animals. By The Medical Mycology Committee of The Medical Research Council. M. R. C. Memorandum No. 23. (London: His Majesty's Stationery Office, 1949.) Pp. 1-12. 6d. net.

Animal pathogens are perhaps even more overburdened with nomenclatural confusion than saprophytes, plant pathogens and industrial moulds. A sign of the renewed interest in Medical Mycology in Britain is a stocktaking and overhauling of nomenclature. G. C. Ainsworth's 'List of fungi recorded as pathogenic to man and higher animals in Britain' was published recently in this *Journal* (*Trans. Brit. mycol. Soc.* **32**, 318-336, 1950). A few weeks earlier, thanks largely to the work of the same writer, the Medical Mycology Committee of the Medical Research Council produced this memorandum giving in a single alphabetical index the names of fungi with synonyms and names of common diseases recommended for use in Britain. This publication should do for medical mycology what the Plant Pathology Committee's *List of Common British Plant Diseases* has already done for diseases of plants.

P. H. G.

A Dictionary of the Fungi. By G. C. AINSWORTH and G. R. BISBY. (Kew, Surrey: The Commonwealth Mycological Institute, 3rd edition, 1950.) viii + 447 pp., 138 text-figures. 20s. net.

The *Dictionary of the Fungi* falls into that rare class of books that every mycologist, except the extreme specialist, needs to keep immediately accessible. It is also invaluable to many other workers who from time to time need a glossary, and a guide to the classification and literature of the fungi. The first edition appeared in 1943. A second revised and greatly enlarged edition appeared in 1945. In the third edition the opportunity has been taken to bring the work thoroughly up to date, and a large proportion of the entries have now been revised.

The book consists of three principal parts. The Dictionary proper occupies 360 pages and contains some 10,000 entries arranged alphabetically. The bulk of the entries comprise the names of all known genera of fungi, their authors, an indication of their taxonomic position if 'good', or the accepted name of those considered to be synonyms. Important genera may have notes on economic significance, on the chief species and on systematic literature. There are numerous general articles on such subjects as antibiotics, classification, genetics, methods, phylogeny, ecology, distribution, history and biographies of authors. Especially valuable to the beginner are the definitions of mycological terms to be found in this section.

Following the alphabetical dictionary comes a section, first added in the second edition, listing the genera of fungi under classes, orders and sometimes families. This section is followed by G. W. Martin's 'Key to the Families of Fungi', occupying 16 pages. In this edition Prof. Martin has revised the key. The number of families in the Myxomycetes has been reduced, while some new families have been added to the Blastocladales (Coelomomycetaceae and Catenariaceae); the Helotiales (Ascocorticaceae and Sclerotiniaceae; and the Cyathariaceae from the Pezizales); and Tremellales (Ceratobasidiaceae). The book ends with a series of figures illustrating types of fungus structure, terms used in describing shapes of spores, etc. The 10 pages of illustrations, however, might well contain more and larger figures if better use were made of the space available.

The entries for some of the principal genera are too short; *Cortinarius* has two lines, *Aspergillus* five, *Peronospora* seven. We hope that in the next edition it will be possible to include the lichens, both in the dictionary and key. It is no criticism of a standard work of this magnitude to ask for more.

P. H. GREGORY

INSTRUCTIONS TO AUTHORS

Contributors to the *Transactions* are asked to be clear and concise, and to use a recent issue of the *Journal* as a guide to the arrangement of headings and subheadings, explanations of plates and figures, references to the literature, and other details. In future each paper should start with a short Summary.

The standards adopted in the *Transactions* are those outlined in the Royal Society's pamphlet, *General Notes on the Preparation of Scientific Papers* (1950, Cambridge University Press, 200 Euston Road, London, N.W. 1, price 2s. 6d.). An exception is that in the *Transactions* citations of references to literature, although based on the Harvard system, include the full titles of the papers and complete page numbers. Titles of journals are abbreviated in accordance with *A World List of Scientific Periodicals*, 1934.

The scientific names of genera and species are printed in italics and should be underlined in the typescript. The title of the paper, headings, and subheadings may be in capitals, but should not be underlined.

The attention of authors proposing new taxonomic groups is drawn to the need to give an adequate description and figure, and to designate the types as required by the *International Rules of Botanical Nomenclature*. The description of a new species should be accompanied by a figure, and whenever possible the type specimen should be deposited in one of the national herbaria.

PREPARATION OF AUTHORS' SUMMARIES

At a recent meeting Council agreed to the adoption of recommendations regarding the preparation of authors' summaries in form suitable for use as abstracts, put forward by the Royal Society. These recommendations are reproduced below for the benefit of contributors.

GUIDE FOR THE PREPARATION OF SYNOPSSES

(1) *Purpose*

It is desirable that each paper be accompanied by a synopsis preferably appearing at the beginning. This synopsis is not part of the paper; it is intended to convey briefly the content of the paper, to draw attention to all new information and to the main conclusions. It should be factual.

(2) *Style of Writing*

The synopsis should be written concisely and in normal rather than abbreviated English. It is preferable to use the third person. Where possible use standard rather than proprietary terms, and avoid unnecessary contracting.

It should be presumed that the reader has some knowledge of the subject but has not read the paper. The synopsis should therefore be intelligible in itself without reference to the paper; for example it should not cite sections or illustrations by their numerical references in the text.

(3) *Content*

The title of the paper is usually read as part of the synopsis. The opening sentence should be framed accordingly and repetition of the title avoided. If the title is insufficiently comprehensive the opening should indicate the subjects covered. Usually the beginning of a synopsis should state the objective of the investigation.

It is sometimes valuable to indicate the treatment of the subject by such words as: brief, exhaustive, theoretical, etc.

The synopsis should indicate newly observed facts, conclusions of an experiment or argument and, if possible, the essential parts of any new theory, treatment, apparatus, technique, etc.

It should contain the names of any new compound, mineral, species, etc., and any new numerical data, such as physical constants; if this is not possible it should draw attention to them. It is important to refer to new items and observations, even though some are incidental to the main purpose of the paper; such information may otherwise be hidden though it is often very useful.

When giving experimental results the synopsis should indicate the methods used; for new methods the basic principle, range of operation and degree of accuracy should be given.

(4) Detail of Layout

It is impossible to recommend a standard length for a synopsis. It should, however, be concise and should not normally exceed 200 words.

If it is necessary to refer to earlier work in the summary, the reference should always be given in the same manner as in the text. Otherwise references should be left out.

When a synopsis is completed, the author is urged to revise it carefully, removing redundant words, clarifying obscurities and rectifying errors in copying from the paper. Particular attention should be paid by him to scientific and proper names, numerical data and chemical and mathematical formulae.

LIST OF MEMBERS

Corrected to 30 June 1950

Honorary Members

- Brooks, Professor F. T., C.B.E., M.A., F.R.S., F.L.S., The Botany School, Downing Street, Cambridge. (1907.) (1948.)
- Dodge, Dr B. O., New York Botanical Garden, Bronx Park, New York 58, N.Y., U.S.A. (1946.)
- Falck, Professor R., Tiberius House, Goldzweig, Palestine. (1946.)
- Gäumann, Professor E., Eidgenössischen Technischen Hochschule, Universitätstrasse, Zürich, Switzerland. (1946.)
- Heim, R., Sous-Directeur au Muséum d'Histoire Naturelle, 11 Rue de Médecins, Paris (6^e), France. (1930.) (1946.)
- Pearson, A. A., F.L.S., Nutcombe House, Hindhead Road, Hindhead, Surrey. (1911.) (1946.)
- Ramsbottom, J., O.B.E., Dr.Sc., M.A., F.L.S., British Museum (Natural History), Cromwell Road, South Kensington, London, S.W. 7. (1910.) (1945.)
- Swanton, E. W., O.B.E., A.L.S., Museum House, High Street, Haslemere, Surrey. (1898.) (1947.)
- Wakefield, Miss E. M., O.B.E., M.A., F.L.S., The Herbarium, Royal Botanic Gardens, Kew, Surrey. (1911.) (1941.)

Members

- Acheson, Miss M. E., Department of Botany, The University, Nottingham. (1949.)
- Adams, Rev. J. H., Landulph Rectory, Hatt, Saltash, Cornwall. (1919.)
- Ainsworth, G. C., B.Sc., Ph.D., F.L.S., Department of Botany, University College, Exeter. (1931.)
- Alaily, Y. A. S. El, Société Anonyme de Wadi Kom-Ombo, P.O. Box 738, Cairo. (1935.)
- Alcock, Mrs N. L., M.B.E., F.L.S., 108 Colebrook Street, Winchester, Hants. (1919.)
- Allchin, J. P., A.I.C., Ministry of Health, Regional Blood Transfusion Service, 17 Highfield Road, Birmingham 15. (1942.)
- Allen, C. Winckworth, 4 Leinster Square, Rathmines, Dublin, Eire. (1946.)
- Alsford, Miss J., 38 Cotesbach Road, London, E. 5. (1950.)
- Andersson, O., Bytaregatan 6b, Lund, Sweden. (1947.)
- Angus, A., Department of Botany, University College, Exeter. (1949.)
- Apinis, A., Department of Botany, The University, Nottingham. (1949.)
- Arif, A. G., M.A., M.Sc., Ph.D., c/o Plant Breeding Institute, School of Agriculture, Cambridge. (1948.)
- Armitage, F. D., A.R.P.S., F.R.M.S., Bargrove Lodge, Boxmoor, Herts. (1942.)
- Ashby, S. F., B.Sc., c/o Barclays Bank, 13 Station Parade, Kew Gardens, Richmond, Surrey. (1926.)
- Ashour, W. El., Ph.D., 7 Nassar St Amire, Fawzia Street, Ejuizeh, Egypt. (1946.)
- Atkins, F. C., Yaxley, Peterborough, Northants. (1945.)
- Austwick, P. K. C., The Herbarium, Royal Botanic Gardens, Kew, Surrey. (1946.)
- Bacon, Mrs A. S., B.Sc., F.L.S., 20 Grand Avenue, Hassocks, Sussex. (1938.)
- Badcock, E. C., Forest Products Research Laboratory, Princes Risborough, Bucks. (1944.)
- Baker, Professor K. F., University of California, 405 Hilgard Avenue, Los Angeles 24, California, U.S.A. (1946.)
- Baker, R. E. D., B.A., Imperial College of Tropical Agriculture, Trinidad. (1944.)

- Balfour-Browne, Mrs F. L., M.Sc., Department of Botany, British Museum (Natural History), Cromwell Road, South Kensington, London, S.W. 7. (1930.)
- Banbury, G. H., 107 Tile Kiln Lane, Bexley, Kent. (1949.)
- Bannan, Miss L., B.Sc., A.R.C.S., 8 Belgrave Road, Chorlton cum Hardy, Manchester. (1945.)
- Barnes, B., D.Sc., Ph.D., F.L.S., Chelsea Polytechnic, London, S.W. 3. (1922.)
- Barnes, Miss E. M., B.Sc., Sir W. Dunn School of Pathology, University of Oxford. (1943.)
- Barr, Rev. R., T.D., M.A., J.P., The Manse, Neilston, Renfrewshire. (1918.)
- Barrington, Dr F. J. F., 52 Harley Street, London, W. 1. (1901.)
- Bates, G. R., Ph.D., c/o Agricultural Department, P.O. Box 387, Salisbury, Southern Rhodesia. (1930.)
- Batko, Dr S., Far End, 41 Shortheath Crescent, Farnham, Surrey. (1944.)
- Batts, C. C. V., B.Sc., Ph.D., National Institute of Agricultural Botany, Huntingdon Road, Cambridge. (1946.)
- Bawden, F. C., M.A., F.R.S., Rothamsted Experimental Station, Harpenden, Herts. (1941.)
- Beaumont, A., M.A., N.A.A.S., Quarry Dene, Weetwood Lane, Leeds 6. (1924.)
- Beedham, Mrs M., B.Sc., 55 Avondale Road, South Croydon. (1948.)
- Bels, Dr P., Provinciale weg 276, Houthem-St Gerlach, Holland. (1949.)
- Bennett, A. J., 84 Henhurst Hill, Burton-on-Trent, Staffs. (1948.)
- Bennett, Miss M., B.Sc. (Hort.), East Malling Research Station, nr. Maidstone, Kent. (1945.)
- Bewley, W. F., C.B.E., D.Sc., Experimental and Research Station, Cheshunt, Herts. (1922.)
- Biggs, Miss R., B.Sc., Ph.D., M.B., B.S., The Radcliffe Infirmary, Oxford. (1945.)
- Birkinshaw, J. H., D.Sc., Firgrove, 4 Nower Hill, Pinner, Middlesex. (1946.)
- Bisby, G. R., Ph.D., Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey. (1921.)
- Black, Miss J. D., B.Sc., British Baking Industries Research Association, Chorleywood Lodge, Chorleywood, Herts. (1949.)
- Blackman, Professor V. H., M.A., Sc.D., F.R.S., F.L.S., 17 Berkeley Place, Wimbledon, London, S.W. 19. (1900.)
- Blackwell, Miss E. M., M.Sc., F.L.S., 16 Stanley Avenue, Birkdale, Southport, Lancs. (1917.)
- Blatchley, C. F. P., Ark Royal, St Helens Wood, St Leonards-on-Sea, Sussex. (1946.)
- Blumer, Dr S., 9 Frohmatt Strasse, Waedenswil, Switzerland. (1936.)
- Bollard, E. G., Plant Diseases Division, Private Bag, Auckland, New Zealand. (1946.)
- Bond, T. E. T., Ph.D., Horticultural Science Laboratories (University of Bristol), Bracken Hill, Leigh Woods, Bristol 8. (1945.)
- Boughey, Professor A. S., B.Sc., Ph.D., University College of the Gold Coast, Achimota, Gold Coast, Africa. (1945.)
- Bourgin, Dr V., 8 Square Vauban, Viroflay, Seine-et-Oise, France. (1936.)
- Boyd, A. E. W., B.Sc., Ph.D., Seed Testing, Plant Registration and Plant Pathology Station, Corstorphine, Edinburgh 12. (1947.)
- Brady, Miss B. L., B.Sc., Swanmead, Datchet, Bucks. (1948.)
- Braid, Professor K. W., B.A., B.Sc., West of Scotland Agricultural College, 6 Blythswood Square, Glasgow, C. 2. (1922.)
- Brenchley, G. H., M.A., N.A.A.S., Staplake Mount, Starcross, Devon. (1925.)
- Brett, Miss M., M.Sc., Ph.D., F.L.S., Greenhills, St Andrews Road, Bridport, Dorset. (1921.)
- Brian, P. W., M.A., Ph.D., Imperial Chemical Industries Ltd., Butterwick Laboratories, The Frythe, Welwyn, Herts. (1944.)

- Brierley, Professor W. B., D.Sc., F.R.A.I., F.L.S., Department of Agricultural Botany, The University, Reading. (1919.)
- Broadfoot, Miss J., B.Sc., c/o Department of Agriculture and Lands, P.O. Box 387, Salisbury, Southern Rhodesia. (1945.)
- Brooke, J., 'Rowmore', Leigh Hill Road, Cobham, Surrey. (1947.)
- Brookfield, Miss E., 28 Fourth Avenue, Linden, Johannesburg, South Africa. (1946.)
- Brown, Miss A. H. S., 28 Abinger Road, Bedford Park, London, W. 4. (1950.)
- Brown, Professor W., M.A., D.Sc., F.R.S., Imperial College of Science and Technology, South Kensington, London, S.W. 7. (1922.)
- Buchwald, Professor N. F., Royal Agricultural and Veterinary College, Rolighedsvej 23, Copenhagen V, Denmark. (1946.)
- Buckley, W. D., 'St Anthony', Leigh Park, Datchet, Bucks. (1916.)
- Buddin, W., M.A., N.A.A.S., Chiltern Court, St Peter's Avenue, Caversham, Reading. (1921.)
- Bulloch, M. G., Blandford Farm Products, Upper Shaftesbury Road, Blandford, Dorset. (1949.)
- Bunting, R. H., F.L.S., 3 Stanton Court, Weymouth. (1921.)
- Burges, Professor N. A., The University, Sydney, N.S.W., Australia. (1935.)
- Burman, A. D., 41 Trinley Road, Knightswood, Glasgow, W. 3. (1947.)
- Burnett, J. H., M.A., Department of Botany, The University, Oxford. (1948.)
- Caldwell, Professor J., D.Sc., Ph.D., Department of Botany, University College, Exeter. (1932.)
- Callen, E. O., B.Sc., Ph.D., F.L.S., Department of Plant Pathology, Macdonald College, McGill University, Quebec, Canada. (1941.)
- Calvert, E. L., M.Agr., Department of Mycology and Plant Pathology, Queen's University, Belfast. (1948.)
- Campbell, A. H., B.Sc., Ph.D., Glaxo Laboratories Ltd., Barnard Castle, Co. Durham. (1934.)
- Canter-Lund, Dr Hilda, Freshwater Biological Association, Wray Castle, Ambleside, Westmorland. (1944.)
- Carr, A. J. H., B.Sc., Welsh Plant Breeding Station, Aberystwyth. (1949.)
- Carrothers, E. N., Ulster Transport Authority, 10 Royal Avenue, Belfast, N. Ireland. (1925.)
- Cartwright, K. St G., M.A., F.L.S., The Old Vicarage, Towersey, Thame, Oxon. (1913.)
- Catsimbas, C., B.Sc., 4 Castellorizon Street, Athens, Greece. (1947.)
- Caulton, D. E., 6 Westcliffe Terrace, Harrogate, Yorks. (1949.)
- Cayley, Miss D. M., Foxhall Cottage, Kelshall, nr. Royston, Herts. (1913.)
- Charlton, Mrs K. M., Imperial Chemical Industries Ltd., Hawthorndale Laboratories, Jealott's Hill Research Station, Bracknell, Berks. (1945.)
- Cheal, W. F., Botley Experimental Station, Botley, Hants. (1927.)
- Chesters, Professor C. G. C., B.Sc., M.Sc., Ph.D., Department of Botany, The University, Nottingham. (1930.)
- Chowdhury, S., Government Mycologist, Jorhat, Assam, India. (1949.)
- Christensen, Dr C. M., University Farm, St Paul 8, Minn., U.S.A. (1945.)
- Ciferri, Professor Dr R., Assistant Director, Laboratorio Crittogamico, Casella Postale 165, Pavia, Italy. (1926.)
- Cleary, J. P., N.A.A.S., Shardlow Hall, Shardlow, nr. Derby. (1948.)
- Cleasby, W. B., Lower Honeydon Farm, nr. Bedford. (1949.)
- Cleland, J. B., M.D., Professor of Pathology, University of Adelaide, South Australia. (1918.)
- Clouston, D., M.A., D.Sc., North of Scotland Agricultural College, 41½ Union Street, Aberdeen. (1931.)
- Colhoun, J., B.Sc., M.Agr., Ph.D., D.I.C., Plant Disease Division, Ministry of Agriculture, Queen's University, Belfast, Northern Ireland. (1943.)

- Collett, Mrs F. W. M., Townsend Farm, Littleton Drew, Chippenham, Wilts. (1948.)
- Cook, W. R. I., B.Sc., Ph.D., Department of Botany, University College, Newport Road, Cardiff. (1924.)
- Cooper, Mrs V. A., The Gables, Barlane, Wakefield, Yorks. (1921.)
- Corner, E. J. H., M.A., F.L.S., Botany School, Downing Street, Cambridge. (1924.)
- Cotton, A. D., O.B.E., V.M.H., F.L.S., Old Weavers, Pitchcombe, nr. Stroud, Glos. (1902.)
- Cottrell, A. R., B.Sc. (Agric.), N.A.A.S., Quarry Dene, Weetwood Lane, Leeds 6. (1948.)
- Critopoulos, Dr P. D., University of Athens, 104 Solonos Street, Athens, Greece. (1949.)
- Crosse, J. E., B.Sc., Research Station, East Malling, Kent. (1948.)
- Crowdy, S. H., B.Sc., A.R.C.S., Research Station, Long Ashton, Bristol. (1946.)
- Croxall, H. E., B.Sc., Ph.D., N.A.A.S., Plant Pathology Laboratory, Henry Street, Evesham, Worcs. (1937.)
- Curtis, Miss K. M., M.A., D.Sc., D.I.C., F.L.S., Mycologist, Biological Department, Cawthron Institute of Scientific Research, Nelson, New Zealand. (1917.)
- Dade, H. A., A.R.C.S., Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey. (1927.)
- Dale, W. T., B.Sc., Imperial College of Tropical Agriculture, Trinidad. (1944.)
- Damiano, C., 81 Exeter House, Putney Heath, London, S.W. 15. (1946.)
- Darlington, R. G., Southcourt Road, Worthing, Sussex. (1949.)
- Davies, D. L. G., Ph.D., N.A.A.S., Crosswood, Aberystwyth, Cards. (1938.)
- Davies, D. W., B.Sc., N.A.A.S., Crosswood, Aberystwyth, Cards. (1923.)
- Davies, H. M., B.Sc., Ph.D., 43 Garrick Close, Walton-on-Thames, Surrey. (1944.)
- Davis, Mrs L. H., Division of Plant Pathology, University of California, Agricultural Experiment Station, Los Angeles 24, California, U.S.A. (1949.)
- Day, W. R., B.A., B.Sc., Imperial Forestry Institute, Oxford. (1928.)
- Deacon, Dr G. E., Brundall, Norwich. (1933.)
- Deighton, F. C., M.A., O.B.E., Mycologist, Department of Agriculture, Njala via Mano, Sierra Leone, West Africa. (1925.)
- Dennis, R. W. G., Ph.D., The Herbarium, Royal Botanic Gardens, Kew, Surrey. (1932.)
- Dickinson, S., Ph.D., School of Agriculture, Cambridge. (1921.)
- Dobbs, C. G., B.Sc., Ph.D., University College of North Wales, Department of Botany, Memorial Buildings, Bangor. (1933.)
- Dodge, Dr C. W., Missouri Botanical Garden, 2315 Tower Grove Avenue, St Louis 10, Missouri, U.S.A. (1926.)
- d'Oliviera, Professor B., Departamento de Fitopatologia, Estação Agronomica Nacional, Sacavem, Portugal. (1939.)
- Dovaston, H. F., Ph.D., West of Scotland Agricultural College, Auchincruive, Ayr. (1946.)
- Dowson, W. J., M.A., D.Sc., The Botany School, Cambridge. (1920.)
- Duddington, C. L., M.A., F.L.S., Biology Department, The Polytechnic, 309 Regent Street, London, W. 1. (1946.)
- Dulaney, Dr E. L., Research and Development Division, Merck and Co. Inc., Rahway, New Jersey, U.S.A. (1950.)
- Duncan, Miss C. W. H., Mushroom Research Association Ltd., Yaxley, Peterborough, Northants. (1949.)
- Duncan, J. T., F.R.C.S., 31 Nightingale Road, Rickmansworth, Herts. (1930.)
- Dunston, Capt. A. E. A., Poolahash, Ballycorus Road, Kilternan, Co. Dublin, Eire. (1937.)
- Dunston, T. F. G. W., Burltons, Donhead St Mary, nr. Shaftesbury, Dorset. (1947.)
- Elliott, A. L., 29 High Street, Pershore, Worcs. (1949.)
- Elliott, Mrs J. S. Bayliss, D.Sc. (B'ham), B.Sc. (London), Dulverton, Manor Way Aldwick Bay, nr. Bognor Regis, Sussex. (1911.)

- Ellis, E. A., F.L.S., Castle Museum, Norwich. (1937.)
- Ellis, M. B., B.Sc., Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey. (1945.)
- Emerson, R., Department of Botany, University of California, Berkeley, California, U.S.A. (1938.)
- English, Miss M. P., M.Sc., Physiological Department, British Drug Houses Ltd., Graham Street, City Road, London, N. 1. (1943.)
- Esplan, Mrs C., The Cottage, King's Arms Hill, Arundel, Sussex. (1949.)
- Eyre, Miss J. C., Wellbottom Lodge, Moulton, nr. Newmarket. (1915.)
- Ferns, J. F., M.Sc., A.I.C., 16 Lawn Crescent, Kew, Surrey. (1942.)
- Fincher, F., Randan Wood, Woodcote, Bromsgrove, Worcs. (1948.)
- Findlay, W. P. K., D.Sc., A.R.C.S., Forest Products Research Laboratory, Princes Risborough, Bucks. (1928.)
- Fisher, S. D. P., 6 The Crescent, Alwoodley Park, Moortown, Leeds. (1930.)
- Fientje, N. T., B Agr.Sci., M.Sc., Department of Botany, Imperial College of Science and Technology, South Kensington, London, S.W. 7. (1949.)
- Fletcher, Mrs P. T., B.A., 22 Foxgrove Avenue, Beckenham, Kent. (1935.)
- Fletcher, W. W., B.Sc., Department of Botany, University of Glasgow. (1948.)
- Foister, C. E., B.A., Ph.D., Plant Pathology Service, Seed Testing Station, East Craigs, Corstorphine, Edinburgh 12. (1940.)
- Forsyth, Miss E. M. E., Biology Department, University College, Swansea, S. Wales. (1947.)
- Fothergill, P. G., B.Sc., Ph.D., King's College, Newcastle-on-Tyne 2. (1946.)
- Frank, Mrs E. M., 2427 East Thornton Road, Lansing, Illinois, U.S.A. (1943.)
- Fraser, Miss L. R., D.Sc., Biological Branch, Department of Agriculture, Box 36A, G.P.O., Sydney, Australia. (1938.)
- Fries, Dr N. Institute of Physiological Botany, The University, Uppsala, Sweden. (1946.)
- Fulford, R. M., 149 Colebourne Road, Birmingham 14. (1949.)
- Gadd, C. H., D.Sc., Tea Research Institute, St Coombs, Talawakelle, Ceylon. (1921.)
- Gallegmore, Miss H. B., Pest Infestation Laboratory, London Road, Slough, Bucks. (1948.)
- Galvin, W. J., Kaysashwell, New House Road, Canterbury, Kent. (1948.)
- Garrett, S. D., M.A., Sc.D., D.I.C., The Botany School, Downing Street, Cambridge. (1936.)
- Gates, L. F., B.A., 115 Ingram Road, Thornton Heath, Surrey. (1947.)
- Gaze, R. W. T., Pathological Laboratory, Royal Infirmary, Leicester. (1949.)
- Gemmell, A. R., B.Sc., Ph.D., M.S., Department of Botany, The University, Manchester 13. (1946.)
- Gentles, J. C., B.Sc., Department of Botany, University of Glasgow. (1948.)
- Gilbert, E. J., Docteur en Pharmacie, 4 Rue de Musset, Paris (16^e), France. (1924.)
- Gill, G. E., LL.B., Law Library, Four Courts, Dublin. (1937.)
- Gillespie, J., B.Sc. (1938.)
- Glasscock, H. H., M.Sc., 20 Upper Bridge Street, Wye, Ashford, Kent. (1949.)
- Glen-Bott, Miss J. I., Ridgeways, Courtshill Road, Haslemere, Surrey. (1949.)
- Glynn, E. St Aubyn, 6A Lancaster Drive, London, N.W. 3. (1946.)
- Glynne, Miss M. D., D.Sc., Rothamsted Experimental Station, Harpenden, Herts. (1932.)
- Godwin, Miss A., B.A., The Botany School, Downing Street, Cambridge. (1949.)
- Gogoi, Miss T., c/o Mr T. H. Gogoi, Bordova, P.O. Lengre, Moranhat, Lakhimpur, Assam, India. (1948.)
- Goidanich, Dr Professor G., Stazione di Patologia Vegetale, Via Suzanna 13, Rome, Italy. (1947.)

- Goodman, R. E. J., Norfolk Flax Establishment, Flitcham Abbey, Flitcham, King's Lynn, Norfolk. (1944.)
- Graddon, W. D., B.Sc., A.M.I.Chem.E., 'Rathgar', Park Lane, Congleton, Cheshire. (1942.)
- Grainger, Miss J., Wilshaw Road, Meltham, nr. Huddersfield. (1943.)
- Grainger, J., B.Sc., Ph.D., Department of Plant Pathology, West of Scotland Agricultural College, Auchincruive, Ayr. (1944.)
- Gray, Miss E. G., B.Sc., Ph.D., North of Scotland Agricultural College, 41½ Union Street, Aberdeen. (1942.)
- Greenwood, E. L., Greenside, The Settlement, Ockbrook, Derby. (1944.)
- Gregg, Miss M., B.Sc., Ph.D., Department of Botany, The University, Edgbaston, Birmingham 15. (1948.)
- Gregory, P. H., Ph.D., D.Sc., Rothamsted Experimental Station, Harpenden, Herts. (1930.)
- Griffiths, E. G., Agricultural Buildings, Alexandra Road, Aberystwyth. (1948.)
- Grossbard, Miss E., Department of Botany, Imperial College of Science and Technology, South Kensington, London, S.W. 7. (1948.)
- Groves, Dr J. Walton, Central Experiment Farm, Ottawa, Canada. (1942.)
- Gwynne, D. C., N.A.A.S., Plant Pathology Department, Elswick Hall, Elswick Park, Newcastle-on-Tyne 4. (1946.)
- Gwynne-Vaughan, Professor Dame Helen, G.B.E., D.Sc., LL.D., F.L.S., 93 Bedford Court Mansions, London, W.C. 1. (1906.)
- Hagen, A., Botanisk Museum, Oslo, Norway. (1949.)
- Haines, V., Department of Botany, University College, Newport Road, Cardiff. (1949.)
- Hainsworth, E., M.A., Tocklai Experimental Station, Cinnamara, P.O. Assam, India. (1946.)
- Hall, Rev. C. A., F.R.M.S., 'Clynder', 71 Landsdowne Road, Worthing. (1948.)
- Hams, A. F., B.Sc., A.R.C.S., Lenton House Cottage, Lenton Experimental Station, Lenton House, Nottingham. (1948.)
- Hanna, W. F., M.Sc., Ph.D., c/o University of Manitoba, Fort Garry, Manitoba, Canada. (1925.)
- Hansford, C. G., M.A., F.L.S. (1921.)
- Harley, J. L., M.A., D.Phil., Department of Botany, The University, Oxford. (1932.)
- Harris, G. C. M., M.A., D.Phil., c/o Commercial Solvents Corporation, Terrehaut, Indiana, U.S.A. (1946.)
- Harris, R. V., D.Sc., A.R.C.S., East Malling Research Station, nr. Maidstone, Kent. (1924.)
- Harrison, T. H., D.Sc., 24 Ray Road, Epping, N.S.W., Australia. (1931.)
- Hart, H. G., Royal Societies Club, 35 Dover Street, London, W. 1. (1946.)
- Haskins, R. H., B.A., M.A., Ph.D., National Research Council, Prairie Regional Laboratory, Saskatoon, Sask., Canada. (1946.)
- Hassell, F. C., 8 Sunbury Gardens, Dartry Road, Dublin, S. 2, Eire. (1946.)
- Hastings, S., M.S., F.R.C.S., 12 Westminster Palace Gardens, Victoria Street, London, S.W. 1. (1913.)
- Hawker, Miss L. E., Ph.D., D.Sc., Department of Botany, The University, Bristol. (1934.)
- Hawkes, Miss J. W., Department of Botany, The University, Nottingham. (1949.)
- Hay, L. A., 76 Hopper Street, Wellington, New Zealand. (1946.)
- Heimbeck, Mrs L., Brosoe, Levanger, Norway. (1923.)
- Hemming, H. G., Imperial Chemical Industries Ltd., Butterwick Laboratories, The Frythe, Welwyn, Herts. (1946.)
- Hendrickx, F. L., Mulungu Experiment Station, I.N.E.A.C., Mulungu, Belgian Congo. (1946.)
- Herd, Miss S. J., B.Sc., Chalk Lane Hotel, 1 Woodcote End, Epsom, Surrey. (1947.)
- Hesseltine, C. W., Lederle Laboratories, Inc., Pearl River, New York, U.S.A. (1948.)

- Hewett, P. D., 61 Chester Drive, North Harrow, Middlesex. (1947.)
- Hickman, C. J., B.Sc., M.Sc., Ph.D., Department of Botany, The University, Edgbaston, Birmingham 15. (1935.)
- Hilton, R. N., M.A., Rubber Research Institute of Malaya, P.O. Box 150, Kuala Lumpur, Malaya. (1948.)
- Hirst, J. M., B.Sc., Rothamsted Experimental Station, Harpenden, Herts. (1949.)
- Hiscott, G. S., Furzy Grove, Kempshott Lane, Basingstoke, Hants. (1944.)
- Hof, Dr T., Centraal Instituut voor Materiaalonderzoek, Rijswijk (Bij Delft), Lange Kleiweg 22, Holland. (1947.)
- Holden, H. S., D.Sc., F.R.S.E., F.L.S., Metropolitan Police Laboratory, New Scotland Yard, London, S.W. 1. (1923.)
- Holliday, P., Imperial College of Tropical Agriculture, St Augustine, Trinidad, British West Indies. (1948.)
- Holmes, G. D., University College of North Wales, Bangor, Caern. (1947.)
- Hora, Dr F. B., The University, Reading, Berks. (1943.)
- Howard, H. J., F.R.M.S., F.L.S., Lingfield, 6 College Road, Norwich. (1918.)
- Howe, F. J., F.R.M.S., Pathological Department, St Cross Hospital, Rugby, Warwickshire. (1943.)
- Hughes, G. C., 20 Priory Road, Bicester, Oxon. (1898.)
- Hughes, J. S., M.A., 65 George Street, Summertown, Oxford. (1927.)
- Hughes, S. J., M.Sc., Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey. (1941.)
- Huijsmann, Dr H. S. C., Oogarts, Doetinchem, Holland. (1947.)
- Hull, R., B.Sc., Ph.D., A.R.C.S., c/o Rothamsted Experimental Station, Field Research Station, Hackthorn, Lincoln. (1942.)
- Hutchings, G. E., Juniper Hall Field Centre, Dorking, Surrey. (1948.)
- Hutchinson, S. A., Ph.D., Department of Botany, The University, Glasgow. (1948.)
- Ingold, Professor C. T., D.Sc., Ph.D., F.L.S., Department of Botany, Birkbeck College, Chancery Lane, London, E.C. 4. (1935.)
- Ingram, Miss M. E. K., Tilgate Horticultural Station, Crawley, Sussex. (1949.)
- Ives, Miss J., 26 Woodlark Road, Cambridge. (1949.)
- Jacks, H., Ph.D., D.I.C., M.Agr.Sc., Dip.Col.Admin., Plant Diseases Division, Auckland, New Zealand. (1947.)
- Jackson, R. M., Department of Botany, The University, Nottingham. (1946.)
- Jay, B. A., M.A., F.L.S., The Quinta, 19 Elm Close, Amersham, Bucks. (1946.)
- Jeffreys, E. G., Imperial Chemical Industries Ltd., Butterwick Laboratories, The Frythe, Welwyn, Herts. (1946.)
- Jenkins, Miss A. E., Bureau of Plant Industry, Department of Agriculture, Washington, D.C., U.S.A. (1942.)
- Jenkins, J. E. E., Plant Pathology Laboratory, Henry Street, Evesham, Worcs. (1949.)
- Johnstone, R. H., 726 Anniesland Road, Glasgow, W. 4. (1938.)
- Jones, D. R., M.A., Ph.D., East African Agriculture and Forestry Research Organisation, Amani, Tanganyika. (1949.)
- Jones, F. G. B., M.A., 32 Kingston Lane, Teddington, Middlesex. (1949.)
- Jones, J. B., N.A.A.S., Plant Pathology Department, University College, Cathays Park, Cardiff. (1948.)
- Jorstad, I., Statsmykolog, Botanisk Museum, Oslo, Norway. (1923.)
- Justham, Mrs M. C. D., Ph.D., N.A.A.S., Bracken Hill, Leigh Woods, Bristol 8. (1945.)
- Keay, Miss M. A., M.A., Ph.D., Commonwealth Potato Collection, Huntingdon Road, Cambridge. (1935.)
- Kelsall, Mrs H. M., 68 Harborne Road, Birmingham 15. (1947.)
- Kent, W. W., Red House, Rodbourne, Swindon, Wilts. (1948.)
- Kerr, A., B.Sc., North of Scotland College of Agriculture, 41½ Union Street, Aberdeen. (1948.)

- Kertland, Miss M. P. H., M.Sc., Department of Botany, Queen's University, Belfast, N. Ireland. (1948.)
- Keyworth, W. G., Ph.D., D.I.C., East Malling Research Station, nr. Maidstone, Kent. (1941.)
- King, J. M. B., 23 Lyncroft Gardens, Ealing, London, W. 13. (1945.)
- Kingston, B. H., 117 The Ridgeway, Wimbledon, London, S.W. 19. (1948.)
- Klein, R., Ph.D., F.L.S., 3 Sussex Place, London, W. 2. (1943.)
- Knoyle, Miss J. M., Department of Biology, University College, Swansea. (1949.)
- Korf, R. P., Department of Plant Pathology, Cornell University, Ithaca, N.Y., U.S.A. (1947.)
- Kramer, L. M. J., M.A., Ph.D., 41 Marlborough Mansions, Cannon Hill, London, N.W. 6. (1946.)
- Krebs, Mrs L., 42 Selcroft Road, Purley, Surrey. (1948.)
- Lane, C. J., 34 Lavender Gardens, London, S.W. 11. (1947.)
- Langdon, R. F., The Botany School, Downing Street, Cambridge. (1950.)
- Lange, M., Universitetets Planteanatometiske Laboratorium, Gothersgade 140, Copenhagen, Denmark. (1949.)
- Large, E. C., Ministry of Agriculture, Plant Pathology Laboratory, Milton Road, Harpenden, Herts. (1948.)
- Last, F. T., B.Sc., A.R.C.S., Rothamsted Experimental Station, Harpenden, Herts. (1949.)
- La Touche, C. J., M.Sc., L.A.H., Department of Bacteriology, Medical School, University of Leeds. (1946.)
- Leach, R., B.A., School of Agriculture, Cambridge. (1929.)
- Lee, O. M., School of Agriculture, Serdang, Selangor, Malaya. (1946.)
- Leech, Mrs E., Arwel, Treddol, Machynlleth, Montg., N. Wales. (1947.)
- Le Gal, Mme. M., Laboratoire de Cryptogamie, Muséum National d'Histoire Naturelle, 12 rue de Buffon, Paris. (1948.)
- Legge, Miss B. J., B.Sc., Department of Cryptogamic Botany, The University, Manchester 13. (1943.)
- Leitch, Miss E. D., Department of Botany, The University, Glasgow. (1948.)
- Lester, E., N.A.A.S., Shardlow Hall, Shardlow, nr. Derby. (1948.)
- Levisohn, Miss I., D.Phil., Bedford College for Women, Regent's Park, London, N.W. 1. (1943.)
- Lloyd, Dr B., Royal Technical College, Glasgow, C. 1. (1946.)
- Locquin, M., Muséum National d'Histoire Naturelle, Paris. (1950.)
- Longley, B., Slape Mills, Netherbury, nr. Beaminster, Dorset. (1946.)
- Lucas, R. L., King's College, Cambridge. (1949.)
- Lütjeharms, Professor W. J., Phil.Nat.D., Department of Botany, University College, Bloemfontein, Orange Free State, S. Africa. (1930.)
- Macdonald, J. A., D.Sc., Ph.D., F.R.S.E., Department of Botany, The University, St Andrews. (1938.)
- McKay, R., B.Sc., A.R.C.S.I., Department of Plant Pathology, Albert Agricultural College, Glasnevin, Dublin, N.W. 3. (1939.)
- McKee, R. K., Nottingham University School of Agriculture, Sutton Bonington, Loughborough, Leics. (1947.)
- Mackinnon, J. E., M.D., Instituto de Higiene, Av. Ramón Anador, 3051 Parque J. Batlle y Ordóñez, Montevideo, Uruguay. (1947.)
- Madge, Miss M. A. P., Ph.D., Royal Holloway College, Englefield Green, Surrey. (1948.)
- Malençon, G., Inspector Principal, Bureau de la Défense Végétaux, 65 bis Avenue de Témara, Rabat, Morocco. (1946.)
- Malone, J. P., B.Sc., Department of Mycology and Plant Pathology, Queen's University, Belfast, N. Ireland. (1948.)
- Manners, J. G., B.A., Department of Botany, University College, Southampton. (1948.)

- Marcan, Mrs B., 335 West Wycombe Road, High Wycombe, Bucks. (1948.)
 Marsh, R. W., M.A., Research Station, Long Ashton, Bristol. (1923.)
 Martens, Professor P., 23 Rue Marie-Thérèse, Louvain, Belgium. (1947.)
 Martin-Scott, I., M.D., 16 Buckingham House, Courtlands, Richmond, Surrey. (1948.)
 Mason, E. W., M.A., M.Sc., F.L.S., Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey. (1921.)
 Mason, Mrs E. W., M.Sc., Inglenook, 63 King's Road, Richmond, Surrey. (1922.)
 Mathias, W. T., B.Sc., The University, Liverpool. (1938.)
 Mathieson, Miss M. J., M.Sc., The Botany School, Downing Street, Cambridge. (1947.)
 Matthews, Professor J. R., M.A., F.L.S., Department of Botany, The University, Old Aberdeen. (1921.)
 Maxted, Mrs B., B.Sc., Ph.D., Department of Botany, The University, Reading. (1934.)
 Mayers, T. T., Queensway Hotel, 11 Prince's Square, London, W. 2. (1949.)
 Melin, Professor J. B. E., Institute of Physiological Botany, Uppsala, Sweden. (1946.)
 Mence, Miss M. J., School of Agriculture, University College of North Wales, Bangor, Caern. (1948.)
 Menzies, Miss B. P., The Botany School, Downing Street, Cambridge. (1948.)
 Miller, Professor J. H., B.S., M.S., Ph.D., University of Georgia, Athens, Ga., U.S.A. (1930.)
 Mishra, J. N. (1948.)
 Mitchell, Miss E. K., Department of Botany, University of Glasgow. (1948.)
 Molina-Llarden, M., Finca Santa Teresa, Tukurú, A. V., Guatemala, Central America. (1947.)
 Mollison, Miss J. E., B.Sc., Ph.D., Rothamsted Experimental Station, Harpenden, Herts. (1948.)
 Montague, Mrs A., Penton, N. Devon. (1898.)
 Montgomery, H. B. S., B.A., Ph.D., D.I.C., Research Station, East Malling, nr. Maidstone, Kent. (1940.)
 Montgomery, Mrs N., Department of Botany, Imperial College of Science and Technology, South Kensington, London, S.W. 7. (1949.)
 Moon, J. Mc. K., Finglush, Station Road, Greenisland, Co. Antrim, N. Ireland. (1948.)
 Moore, Miss F. J., Ph.D., Ministry of Agriculture, Plant Pathology Laboratory, Milton Road, Harpenden, Herts. (1945.)
 Moore, M. H., M.Sc., Ph.D., East Malling Research Station, nr. Maidstone, Kent. (1940.)
 Moore, W. C., M.A., Ministry of Agriculture, Plant Pathology Laboratory, Milton Road, Harpenden, Herts. (1922.)
 Morris, L. E., c/o Eton College, Windsor, Berks. (1924.)
 Moser, M., Innsbruck, Müllerstrasse 9, Austria. (1949.)
 Mount, Miss S., Department of Botany, Imperial College of Science and Technology, South Kensington, London, S.W. 7. (1948.)
 Moureau, Dr J., Laboratoire de Phytopathologie, I.N.E.A.C., Yangambi, Belgian Congo. (1944.)
 Munro, H. R., The Uplands, Monument Lane, Rednal, Birmingham. (1948.)
 Munson, R. G., 15 Munro Gardens, Harrow Weald, Middlesex. (1943.)
 Murray, J. S., B.Sc., Forest Research Station, Alice Holt Lodge, nr. Wrecclesham, Farnham, Surrey. (1950.)
 Muskett, Professor A. E., D.Sc., A.R.C.S., M.R.I.A., Queen's University, Belfast, Northern Ireland. (1923.)
 Nannfeldt, Professor J. A., Sturegatan 11, Uppsala, Sweden. (1932.)
 Nash-Wortham, J. R. H., 9 Harrington Road, Preston Park, Brighton, Sussex. (1937.)
 Nattress, R. M., B.Sc. (Agric.), Ph.D., Department of Agriculture, P.O.B. 338. Nairobi, Kenya. (1925.)

- Newby, H. V., Department of Botany, Queen Mary College, London, E. 1. (1946.)
- Newhook, F. J., M.Sc., Ph.D., D.I.C., Plant Diseases Division, D.S.I.R., Private Bag, Auckland, New Zealand. (1946.)
- Nicholls, Miss V. O., Department of Botany, University of Bristol. (1949.)
- Nobbs, Miss G. E. D., 4 Clifton Estate, Plympton, S. Devon. (1943.)
- Noble, Miss M., B.Sc., Ph.D., 19A Willowbrae Avenue, Edinburgh. (1940.)
- Noel, Miss E. F., F.L.S., 37 Burnham Court, Queen's Road, London, W. 2. (1913.)
- Nye, A. L., Annat Lodge, Kinnoull, Perth, Scotland. (1949.)
- O'Connor, P., Ph.D., B.Sc., A.R.C.Sc.I., National Museum, Dublin. (1925.)
- Ogilvie, L., M.A., M.Sc., N.A.A.S., Bracken Hill, Leigh Woods, Bristol 8. (1922.)
- Olliver, C. W., c/o Lloyds Bank Ltd., 50 Notting Hill Gate, London, W. 11. (1942.)
- Orton, P. D., M.A., A.R.C.M., Epsom College, Epsom, Surrey. (1947.)
- Padwick, Dr G. W., Imperial Chemical Industries Ltd., Nobel House, 2 Buckingham Gate, London, S.W. 1. (1936.)
- Page, Miss W. M., M.Sc., Ph.D., 5 Dartmouth Chambers, Theobald's Road, London, W.C. 1. (1921.)
- Palmer, J. T., 5 Station Road, Woodley, Stockport, Cheshire. (1950.)
- Parker, H. M., Brereton, Lyth Hill Road, Bayston Hill, Shrewsbury, Salop. (1949.)
- Paton, Miss M. R., Hareshawmuir by Kilmarnock, Ayrshire. (1945.)
- Peach, Mrs M., 5 Tybenham Road, Merton Park, London, S.W. 19. (1947.)
- Peklo, Professor Dr J., Institute of Phytopathology, College of Agriculture and Forestry, Prague XIX, Dejvice, Czechoslovakia. (1924.)
- Pettifer, A. J., 36 Cheviot Gardens, Hendon Way, London, N.W. 2. (1944.)
- Peyronel, Professor B., Directeur, Instituto di Patologia Vegetale, Via Pietro Giuria 15, Torino, Italy. (1932.)
- Phillips, D. H., M.Sc., Department of Botany, The University, Nottingham. (1950.)
- Phillips, Dr H. H., 11 Kings End, Bicester, Oxon. (1923.)
- Pilát, Dr A., Department of Botany, National Museum, Zahradni 44, Prague XIX, Czechoslovakia. (1946.)
- Ping, A. W., M.A., 17 Grosvenor Terrace, Bootham, York. (1926.)
- Pinto-Lopes, Dr J., Faculdade de Ciências, Lisboa, Portugal. (1949.)
- Plack, R. L., Hugh Stewart Hall, Derby Road, Nottingham. (1947.)
- Platt, J., B.Sc., 54 Eldon Road, Cheltenham, Glos. (1947.)
- Plunkett, B. E., B.Sc., Department of Botany, Birkbeck College, London, E.C. 4. (1945.)
- Pollak, Mrs R. A., Department of Botany, University of California, Los Angeles 24, California, U.S.A. (1949.)
- Pollard, H. B. C., 13 Abercorn Place, London, N.W. 8. (1949.)
- Porter, Mrs L., M.Sc., 4A Kent Terrace, Dalkey, Co. Dublin, Eire. (1949.)
- Porter, S. C., A.R.I.C., A.M.I.Chem.E., 42 Crofton Road, Ipswich, Suffolk. (1946.)
- Prentice, I. W., B.Sc., Ph.D., Ministry of Agriculture, Plant Pathology Laboratory, Milton Road, Harpenden, Herts. (1943.)
- Preston, N. C., B.Sc., N.A.A.S., Woodthorne, Wolverhampton, Staffs. (1920.)
- Prowse, G. A., Department of Botany, Birkbeck College, Chancery Lane, London, E.C. 4. (1949.)
- Ramsbottom, Miss M., 34 Ennerdale Road, Richmond, Surrey. (1946.)
- Rautavaara, Dr T., Maneesik 1B, Helsinki, Finland. (1949.)
- Rauter, Dr F., 74 Carlton Hill, London, N.W. 8. (1942.)
- Ray, Miss A., Penarwyn, Gorran Haven, Gorran, Cornwall. (1929.)
- Rees, J., M.Sc., Y Faerdref, 404 Cyncoed Road, Cardiff. (1929.)
- Reichert, Dr I., Agricultural Research Station, Rehovot, Israel. (1924.)
- Richards, B., Hartley Manor, Longfield, Kent. (1948.)
- Riddell, R. W., M.D., M.R.C.P., London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C. 1. (1950.)

- Ritson, W., 12 West Street, Winwick Road, Warrington, Lancs. (1946.)
- Roberts, E. T., B.Sc., A.R.C.S., N.A.A.S., Chiltern Court, St Peter's Avenue, Caversham, Reading, Berks. (1947.)
- Roberts, Miss F. M., Ph.D., Rothamsted Experimental Station, Harpenden, Herts. (1948.)
- Roberts, Miss M., 7 Manson Place, London, S.W. 7. (1949.)
- Robertson, A. G., B.Sc., 23 Cotham Road, Cotham, Bristol 6. (1948.)
- Robertson, N. F., The Botany School, Downing Street, Cambridge. (1945.)
- Robinson, E., 26 Burwood Avenue, Eastcote, Pinner, Middlesex. (1938.)
- Rogers, Dr D. P., New York Botanical Garden, Bronx Park, New York 58, N.Y., U.S.A. (1943.)
- Rogerson, C. T., Department of Plant Pathology, Cornell University, Ithaca, N.Y., U.S.A. (1947.)
- Roscoe-Abbott, Capt. J., B.Sc., The School House, Withern, Alford, Lincolnshire. (1946.)
- Rose, H. V., Morden College, Blackheath, London, S.E. 3. (1944.)
- de Rousset-Hall, O., M.A., 44 Great Bowden Road, Market Harborough, Leics. (1942.)
- Roy, R. Y., Hindu University, Benares, India. (1947.)
- Salam, M.A., B.A., M.Sc., Ph.D., Department of Botany, Osmania University, Hyderabad, Deccan, India. (1948.)
- Salt, G. A., M.A., Plant Pathology Department, Rothamsted Experimental Station, Harpenden, Herts. (1946.)
- Sampson, Miss K., M.Sc., Malmsmead, Lacey Green, nr. Aylesbury, Bucks. (1920.)
- Samuel, G., M.Sc., Agricultural Research Council, 6A Dean's Yard, Westminster, S.W. 1. (1923.)
- Sansome, Mrs E. R., M.Sc., Department of Botany, The University, Ibadan, Nigeria. (1945.)
- Savory, J. G., B.Sc., Forest Products Research Laboratory, Princes Risborough, nr. Aylesbury, Bucks. (1946.)
- Schärer-Bider, W., Peter Rot-Str. 58, Bâle, Switzerland. (1947.)
- Schimmer, Miss F. C., M.Sc., Wye College, Ashford, Kent. (1943.)
- Searle, G. O., B.Sc. (Agric.), Flax Research Institute, Flitcham Abbey, Flitcham, King's Lynn, Norfolk. (1920.)
- Sefton, Dr L., 40 Menelik Road, London, N.W. 2. (1948.)
- Shapiro, A., Middlesex Colony, Harper Lane, Shenley, Herts. (1946.)
- Shea, H. A. W., 15 Birchwood Court, Edgware, Middlesex. (1948.)
- Shear, Dr C. L., 2253 N. Madison Street, Arlington, Virginia, U.S.A. (1930.)
- Sheard, Mrs E., Fairfield Farm, Esprick, nr. Kirkham, Lancs. (1937.)
- Sidky, S. T., D.I.C., Ph.D., Ministry of Agriculture, Mycological Department, Cairo, Egypt. (1947.)
- Sirry, A. R., B.Sc., Department of Plant Pathology, West of Scotland Agricultural College, Auchincruive, Ayr. (1950.)
- Sisley, C., Cuprinol Department, Robbialac Paints, 36 St James's Street, London, S.W. 1. (1947.)
- Skene, Professor Macgregor, Department of Botany, The University, Bristol 8. (1936.)
- Smith, C. E. D., King's College, The Strand, London, W.C. 2. (1949.)
- Smith, Miss E. K. Goldie, Royal Holloway College, Englefield Green, Surrey. (1944.)
- Smith, G., M.Sc., F.R.I.C., London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C. 1. (1936.)
- Smith, Miss J. L., B.Sc., Clove Research Scheme, Livingstone House, Zanzibar. (1946.)
- Smith, N. J. G., Ph.D., B.Sc., 19 Fitzroy Street, Grahamstown, S. Africa. (1924.)
- Snow, D., Ph.D., Department of Agricultural Botany, The University, Reading, Berks. (1947.)
- Sowter, F. A., F.L.S., 9 North Avenue, Leicester. (1942.)
- Sparks, Miss G. M., 7 Taviton Street, London, W.C. 1. (1950.)

- Sparrow, Dr F. K., Department of Botany, University of Michigan, Ann Arbor, Mich., U.S.A. (1946.)
- Spilsbury, J. F., B.Sc., W.P.R.L., Langley Court, Beckenham, Kent. (1946.)
- Stakman, Professor E. C., University of Minnesota, Department of Agriculture, University Farm, St Paul 8, Minn., U.S.A. (1922.)
- Stamps, Miss D. J., B.Sc., 31 Beeches Road, West Bromwich, Staffs. (1948.)
- Stenton, H., The Botany School, Downing Street, Cambridge. (1948.)
- Stephens, Miss E. L., B.A., Department of Botany, University of Cape Town, South Africa. (1928.)
- Stevenson, Dr J. A., 4113 Emery Place, N.W., Washington 16, D.C., U.S.A. (1927.)
- Stewart, Miss D. D., 21 Keats Grove, Hampstead, London, N.W. 3. (1946.)
- Steyaert, R. L., Ing.A.I.Gx., 159 Rue des Atrebrates, Etterbeek, Brussels iv, Belgium. (1931.)
- Stiles, Professor W., Sc.D., F.R.S., Department of Botany, The University, Edgbaston, Birmingham 15. (1936.)
- Stirrup, H. H., M.Sc., N.A.A.S., Shardlow Hall, Shardlow, nr. Derby. (1922.)
- Stockdale, Miss P. M., B.Sc., Department of Botany, University College, Exeter. (1950.)
- Storey, H. H., M.A., Ph.D., C.I.M.G., F.R.S., East African Agriculture and Forestry Research Organization, Amani, Tanganyika. (1922.)
- Storey, I. F., Ph.D., N.A.A.S., Quarry Dene, Weetwood Lane, Leeds 6. (1941.)
- Stubbs, J., B.Sc., Ph.D., Imperial Chemical Industries Ltd., Hawthorndale Laboratories, Jealott's Hill Research Station, Bracknell, Berks. (1947.)
- Talbot, P. B. H., Ph.D., P.O. Box 994, Pretoria, South Africa. (1945.)
- Talboys, P. W., Plant Pathology Department, Research Station, East Malling, Kent. (1948.)
- Taylor, J. C., B.Sc., B.Agr., Department of Mycology and Plant Pathology, Queen's University, Belfast, N. Ireland. (1948.)
- Tervet, I. W., B.Sc., Camp Detrick, Frederick, Maryland, U.S.A. (1933.)
- Thomas, D. G., Heathfield, Upper Tumble, Llanelly, Carmarthen. (1946.)
- Thomas, Miss E. M., University House, Edgbaston Park Road, Birmingham 15. (1949.)
- Thomas-Perrott, Mrs P. E., The Training College, Dudley, Worcs. (1945.)
- Thompson, Miss E. C., East Malling Research Station, nr. Maidstone, Kent. (1942.)
- Thompson, Miss J., B.Sc., Ph.D., Department of Biology, College of Technology and Commerce, Leicester. (1947.)
- Thompson, Mrs K., 7 Nevern Square, London, S.W. 5. (1947.)
- Thurston, Miss J. M., B.Sc., Rothamsted Experimental Station, Harpenden, Herts. (1942.)
- Tipler, R. V., B.Sc., A.R.C.S., Imperial Chemical Industries Ltd., Hawthorndale Laboratories, Jealott's Hill Research Station, Bracknell, Berks. (1945.)
- Tolba, M. K., B.Sc., M.Sc. (Cairo), Faculty of Science, Giza, Egypt. (1947.)
- Tomkins, R. G., M.A., Ph.D., Director, Ditton Laboratory, East Malling, nr. Maidstone, Kent. (1925.)
- Tomlinson, J. A., B.Sc., Ministry of Agriculture, Plant Pathology Laboratory, Milton Road, Harpenden, Herts. (1948.)
- Topping, Mrs M. D., B.Sc., 32 Eastwood Drive, Littleover, Derby. (1933.)
- Topping, Mrs M. P., Angroban, Fir Tree Road, Leatherhead, Surrey. (1947.)
- Tribe, H. T., 25 Clivedon Road, Wimbledon, London, S.W. 19. (1949.)
- Trouern-Trend, K., Standlynch Farmhouse, Trafalgar, Downton, nr. Salisbury, Wilts. (1946.)
- Tunstall, A. C., Maxwelton, Shillong P.O., Assam, India. (1933.)
- Turner, Miss D. M., M.Sc., Department of Agriculture, The University, Leeds. (1950.)
- Turner, Miss E. M., B.A., Ph.D., Old School House, Great Haseley, Oxon. (1940.)
- Turner, Mrs F. M., Rosecot, 3 Clevedon Road, Lower Tilehurst, Reading, Berks. (1943.)
- Turner, Mrs M., M.Sc., Department of Botany, The University, Nottingham. (1945.)

- Twyman, E. S., B.Sc., M.Sc., Ph.D., Department of Botany, The University, Edgbaston Birmingham 15. (1942.)
- van-Beverwijk, Miss A. L., Eemnesserweg 42, Baarn, Holland. (1947.)
- van Eyndhoven, G. L., Eindhovenstraat 36, Haarlem, Holland. (1947.)
- Vanterpool, T. C., M.Sc., Department of Botany, University of Saskatchewan, Saskatoon, Canada. (1929.)
- Venkatrayan, S. V., Mycologist, Agricultural Department, Bangalore, Mysore State, India. (1935.)
- Vincent, Miss M., Paddington Baths, London, W. 10. (1949.)
- Vines, Professor W. S., University College, Hull, E. Yorks. (1947.)
- Wadham, Professor S. M., M.A., Department of Agriculture, The University, Melbourne, Victoria, Australia. (1922.)
- Waldie, J. S. L., B.Sc., C.D.A., Department of Agricultural Botany, The University, Reading. (1925.)
- Walker, A. G., Ph.D., N.A.A.S., Wye, nr. Ashford, Kent. (1946.)
- Walker, Mrs J., London School of Hygiene and Tropical Medicine, Keppel Street, London. W.C. 1. (1947.)
- Wallace, E. R., M.A., 168 West Parade, Lincoln. (1934.)
- Wallace, G. B., B.Sc. (Agric.), Ph.D., Lyamungu, Moshi, Tanganyika Territory, E. Africa. (1928.)
- Warcup, J. H., M.Sc., The Botany School, Cambridge. (1947.)
- Ward, Miss G. M., Department of Botany, The University, Nottingham. (1950.)
- Wardlaw, Professor C. W., Department of Cryptogamic Botany, The University, Manchester 13. (1943.)
- Warne, Mrs M. M., B.A., 25 Amherst Road, Fallowfield, Manchester 14. (1937.)
- Warren, Dr Clara M., M.R.C.S., L.R.C.P., Fiveways, Leyborne Park, Kew, Richmond, Surrey. (1946.)
- Waterhouse, Miss G. M., M.Sc., 95 Knightwood Crescent, New Malden, Surrey. (1927.)
- Waterston, J. M., B.Sc., Ph.D., Agricultural Department, Ibadan, Nigeria, West Africa. (1934.)
- Watson, W., D.Sc., A.L.S., Cedenc, Cheddon Road, Taunton, Som. (1923.)
- Watson-Walker, J., The Bungalow, Ladygate, Diseworth, Derby. (1949.)
- Webb, P., Ph.D., Clare Cottage, East Malling, nr. Maidstone, Kent. (1938.)
- Webb, R. A., B.A., D.Phil., National Hospital, Queen's Square, London, W.C. 1. (1936.)
- Webster, J., B.Sc., Department of Botany, The University, Sheffield 10. (1945.)
- Westerdijk, Professor Johanna, Javalaan 4, Baarn, Holland. (1923.)
- Western, J. H., B.Sc., Ph.D., N.A.A.S., Elswick Hall, Elswick Park, Newcastle-on-Tyne. (1934.)
- Weston, W. A. R. Dillon, M.A., Ph.D., N.A.A.S., Anstey Hall, Trumpington, Cambridge. (1923.)
- Whitaker, F. O., 51 Grosvenor Avenue, Carshalton, Surrey. (1921.)
- White, N. H., D.Sc., Faculty of Agriculture, The University, Sydney, New South Wales, Australia. (1944.)
- White, Dr W. L., Biological Laboratories, Philadelphia Quartermaster Depot, 2800 South 20th Street, Philadelphia 45, Pa., U.S.A. (1947.)
- Whitehead, T., D.Sc., A.R.C.S., N.A.A.S., Bryn Adda, Bangor, Caern. (1920.)
- Whitehouse, H. L. K., The Botany School, Downing Street, Cambridge. (1948.)
- Whiteside, J. O. (1948.)
- Wilkins, W. C., Pleasant View, Johnstown, Carmarthen, Carms. (1947.)
- Wilkins, W. H., M.A., D.Phil., Department of Botany, The University, Oxford. (1928.)
- Wilkinson, E. H., B.Sc., Ph.D., Newnham Farms, Newnham Bridge, nr. Tenbury Wells, Worcs. (1938.)
- Williams, P. H., B.Sc., Experimental and Research Station, Cheshunt, Herts. (1930.)
- Wilson, Miss A. P., M.B.E., A.R.C.S., 7A Arlington Drive, Nottingham. (1929.)

- Wilson, A. R., Ph.D., Nottingham University School of Agriculture, Sutton Bonington, Loughborough. (1933.)
- Wilson, Miss I. M., B.Sc., Ph.D., Department of Botany, University College of Wales, Aberystwyth. (1938.)
- Wilson, J. F., B.Sc., Stourton Cottage, Ewhurst, Robertsbridge, Sussex. (1950.)
- Wilson, M., D.Sc., A.R.C.S., F.L.S., Royal Botanic Garden, Edinburgh. (1912.)
- Wiltshire, S. P., D.Sc., Commonwealth Mycological Institute, Ferry Lane, Kew, Surrey. (1920.)
- Wolf, Dr F. A., Department of Botany, Duke University, Durham, North Carolina, U.S.A. (1940.)
- Wolf, Dr F. T., Vanderbilt University, Nashville, Tennessee, U.S.A. (1940.)
- Wood, F. C., The Rest, Franklin Road, Durrington, Worthing. (1935.)
- Wood, R. K. S., Ph.D., A.R.C.S., Department of Botany, Imperial College of Science and Technology, South Kensington, London, S.W. 7. (1946.)
- Wood-Baker, Mrs A. W., Birkbeck College, Chancery Lane, London, E.C. 4. (1948.)
- Woodcock, A. J. A., M.Sc., F.E.S., Rhianva, 65 Rock Avenue, Gillingham, Kent. (1926.)
- Woodward, R. C., Ph.D., Overseas Development Dept., Plant Protection Ltd., Bolton House, 61 Curzon Street, Piccadilly, London, W. 1. (1924.)
- Wormald, H., D.Sc., A.R.C.S., East Malling Research Station, nr. Maidstone, Kent. (1921.)
- Wright, F. R. E., Braunton, N. Devon. (1946.)
- Wright, Miss J. M., Imperial Chemical Industries Ltd., Butterwick Research Laboratories, The Frythe, Welwyn, Herts. (1949.)
- Wyatt, F. M., Tilgate Horticultural Station, Crawley, Sussex. (1949.)
- Yalden, Miss M. E., High Street, East Malling, nr. Maidstone, Kent. (1948.)
- Yuill, E., 35 Askham Lane, Acomb, York. (1937.)

Associates

- Bain, Miss J., Royal Holloway College, Englefield Green, Surrey. (1948.)
- Banks, Miss M. J., Somerville College, Oxford. (1949.)
- Beaumont, Miss B. S., 40 Lidgit Street, Lindley, Huddersfield, Yorks. (1947.)
- Bolton, Miss M., Oakleigh, 20 Druid Road, Stoke Bishop, Bristol 9. (1947.)
- Bray, Miss M. F., Imperial Chemical Industries Ltd., Hawthorndale Laboratories, Jealott's Hill Research Station, Bracknell, Berks. (1949.)
- Broadfoot, D. N., 9 Crest View Drive, Petts Wood, Orpington, Kent. (1948.)
- Brokenshire, F. A., 2 Rock Avenue, Barnstaple, N. Devon. (1946.)
- Brown, Miss E. A., 8 Twyford Crescent, Acton, London, W. 3. (1947.)
- Brown, Miss J. E., 1 Heath Road, Ipswich, Suffolk. (1948.)
- Brunner, Miss N., 9 Upper Clanbrasil Street, Dublin, Eire. (1949.)
- Callan, I. W. Mc. C., B.Sc., Dip.Agr.Sc., 19 Alexandra Road, Reading. (1950.)
- Cannons, C. E., 33 Langley Oaks Avenue, Sanderstead, Surrey. (1949.)
- Charlton, J. L., B.Sc., Dip.Bact., Imperial Chemical Industries Ltd., Hawthorndale Laboratories, Jealott's Hill Research Station, Bracknell, Berks. (1947.)
- Chesters, Miss K. I. M., 101 Harlaxton Drive, Lenton Sands, Nottingham. (1947.)
- Cook, Miss J. M., 61 Frederick Road, Wyld Green, Sutton Coldfield, nr. Birmingham. (1947.)
- Cook, Mrs M. E. I., Westra Lodge, Dinas Powis, S. Wales. (1949.)
- Cryer, Miss J., Imperial Chemical Industries Ltd., Jealott's Hill Research Station, Bracknell, Berks. (1950.)
- Dobbs, Mrs C. G., 101 Gladstone Terrace, Bangor, Caern. (1947.)
- Ellis, Mrs M. B., 154 Kew Road, Richmond, Surrey. (1947.)
- Gartside, R. N., Merton College, Oxford. (1949.)
- Geoghegan, Miss M. E., St Patrick's Hall, Reading. (1950.)

- Gobbett, R. H., 11 Rostrevor Road, Fulham, London, S.W. 6. (1948.)
 Godwin, Miss R., Royal Holloway College, Englefield Green, Surrey. (1949.)
 Gray, Miss M. R., 43 Woodcroft Avenue, Mill Hill, London, N.W. 7. (1947.)
 Gregory, Mrs M. F., 47 Milton Road, Harpenden, Herts. (1945.)
 Harvey, Miss E. M., 12 King George Street, Greenwich, London, S.E. 10. (1946.)
 Hepton, Miss S. V., Lady Margaret Hall, Oxford. (1949.)
 Hooper, Miss S., Royal Holloway College, Englefield Green, Surrey. (1948.)
 Jacobs, J. A., M.A., A.F.R.Ae.S., 10 Woodland Avenue, Windsor, Berks. (1946.)
 James, L., 19 Bushey Road, Ickenham, Uxbridge, Middlesex. (1947.)
 Johnson, Miss S. M., St Hilda's College, Oxford. (1949.)
 Kelsall, R. K., 68 Harborne Road, Birmingham 15. (1947.)
 Lickfold, Miss K. E., 83 Largewood Avenue, Tolworth, Surbiton, Surrey. (1947.)
 Lock, Miss H. M., 99 Thames Drive, Leigh-on-Sea, Essex. (1947.)
 Lofts, Miss M. J., Corn Hill House, Sherborne, Dorset. (1947.)
 Martin, Miss J., B.Sc., 1 Brooklyn Court, Orwell Road, Felixstowe. (1947.)
 Mather, Miss J., 21 Hangingstone Road, Berry Brow, Huddersfield. (1949.)
 Mayer, Miss B. M., 171 Avery Hill Road, New Eltham, London, S.E. 9. (1946.)
 Metcalfe, C. R., B.A., Ph.D., Jodrell Laboratory, Royal Botanic Gardens, Kew, Surrey. (1947.)
 Molesworth, Miss B., Studley College, Studley, Warwickshire. (1945.)
 Montgomery, W. E., The Metropolitan Police Laboratory, New Scotland Yard, London, S.W. 1. (1950.)
 Moore, Mrs W. C., Vallis, Amenbury Lane, Harpenden, Herts. (1945.)
 Neville, W. J. J., 10 Penmaen Road, Conway, N. Wales. (1949.)
 Noaks, Miss B. A., 25 Waldegrave Gardens, Twickenham, Middlesex. (1947.)
 Osterburg, Miss V. M., 'Orlingbury', Lawn Avenue, West Drayton, Middlesex. (1946.)
 Partridge, Miss B. M., Standards Laboratory, Central Public Health Laboratory, Colindale Avenue, London, N.W. 9. (1946.)
 Pollard, Mrs R. M., 13 Abercorn Place, London, N.W. 8. (1949.)
 Powlisland, Miss M. R., Dorma, Trelawney Road, Plympton, Devon. (1949.)
 Prentice, Mrs M. M., 12A Langdale Avenue, Harpenden, Herts. (1945.)
 Read, Miss L. M., East Malling Research Station, nr. Maidstone, Kent. (1946.)
 Rees, Miss J. R., 51 Beech Croft Road, Oxford. (1950.)
 Reid, D. A., Department of Botany, University College, Hull. (1950.)
 Rhodes, Miss I. C., 17 Jervis Crescent, Streetly, Sutton Coldfield, Warwickshire. (1949.)
 Rolinson, G. N., Flat 2, 30 Waterloo Road, Nottingham. (1948.)
 Stevenson, Miss H. C., 11 Fosse Way, Ealing, London, W. 13. (1947.)
 Tipler, Mrs M. K., B.Sc., 2 Waterside Lodge, Raymead Road, Maidenhead, Berks. (1945.)
 Vachell, Miss E., F.L.S., Fairfield, Llandaff, Cardiff. (1945.)
 Way, Miss A. M., B.Sc., Imperial Chemical Industries Ltd., Hawthorndale Laboratories, Jealott's Hill Research Station, Bracknell, Berks. (1949.)
 Webb, Miss M. B., 22 Bristol Road, Chippenham, Wilts. (1948.)
 Webster, B. N., 30 Marksbury Avenue, Richmond, Surrey. (1948.)
 Weston, Mrs S. D., Howe Farm House, Huntingdon Road, Cambridge. (1948.)
 Wheeler, B. E. J., Department of Botany, University of Bristol. (1949.)
 Wilman, Miss A. M., B.Sc., Bolus Herbarium, University of Cape Town, Rondebosch, S. Africa. (1947.)

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